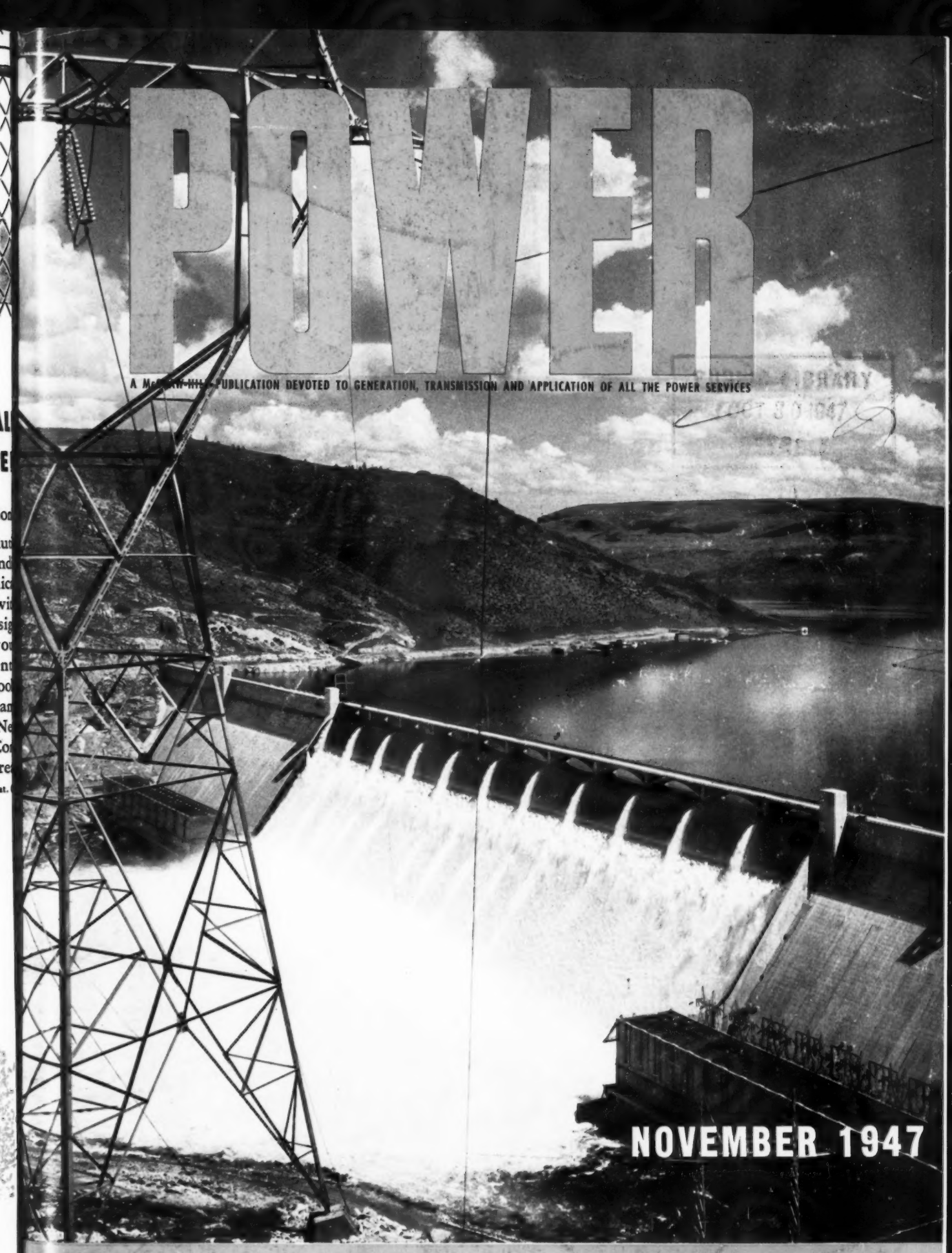

POWER

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES

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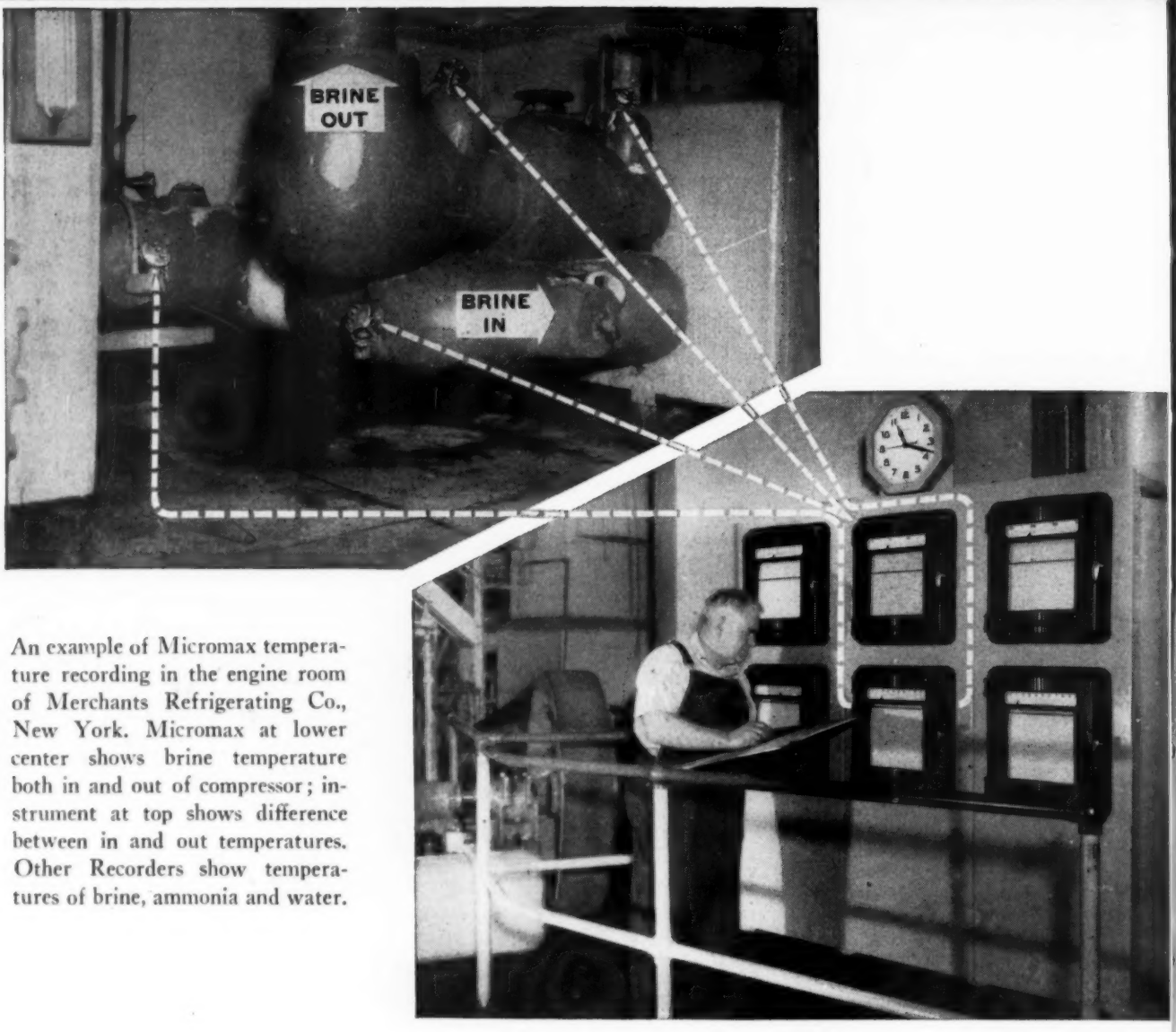
NOVEMBER 1947

This issue features: Engineering details of the Grand Coulee plant (above), 3,000,000-hp keystone of the Pacific Northwest's vast hydro potential, p 64; possibilities in higher steam temperatures, p 69; fundamentals of chemical dehumidification, p 74; the part coal properties play in smokeless combustion, p 84 **Table of Contents, p 59**



An example of Micromax temperature recording in the engine room of Merchants Refrigerating Co., New York. Micromax at lower center shows brine temperature both in and out of compressor; instrument at top shows difference between in and out temperatures. Other Recorders show temperatures of brine, ammonia and water.

WIRES are Cheaper than LEGS for Carrying Temperature Readings

A man would have to hustle almost continuously, from compressor to engine to heat-exchanger, in order to collect by hand all the temperature readings which are collected for him, automatically, by the Micromax Recorders shown above. And the readings might not be as accurate, especially for thermometers located above eye level, or in dark corners Furthermore, there's always the chance of error in writing down the temperature, and temperature errors can mean costly refrigeration.

All these troubles vanish when Micromax Recorders are used. The engineer can see every temperature on every machine by moving only three or four feet. Each is measured for him by a micro-responsive instrument which is far more sensitive and accurate than the best human eye. And temperatures are automatically recorded at full ac curacy—if the log-sheet entry is ever questioned, it ca always be checked against the record.

Building Temperatures, too.

Micromax Recording is not limited to engines, or t machine temperatures. Storage spaces three floors up—o apartments thirty floors—can have detectors, with Micro max concentrating the information at any convenient loca tion.

If you merely wish information about the instrument required, ask for Catalog N-33C. But if you have a specifi problem or situation in mind, and can give us the highlights an L&N engineer can be of service in providing specific facts Leeds & Northrup Co., 4910 Stenton Ave., Phila. 44, Pa

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

JRL. AD N-33C-520(1)

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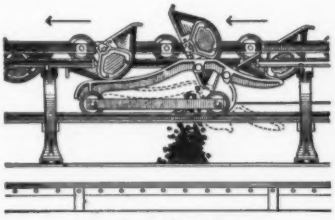
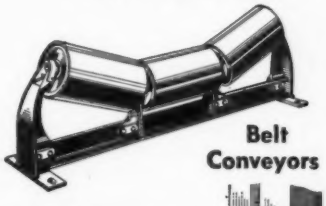
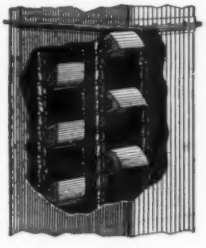
Meets Every Need of Industry in Handling Materials



Bucket Carriers



Belt Conveyors

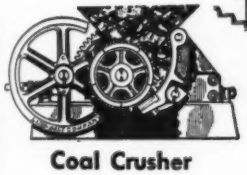


Bucket Elevators

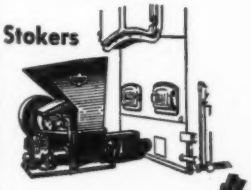
Bulk-Flo

Screw Conveyor

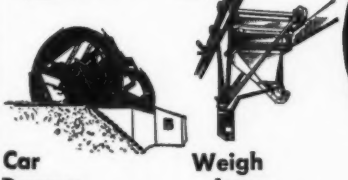
Skip Hoist



Coal Crusher



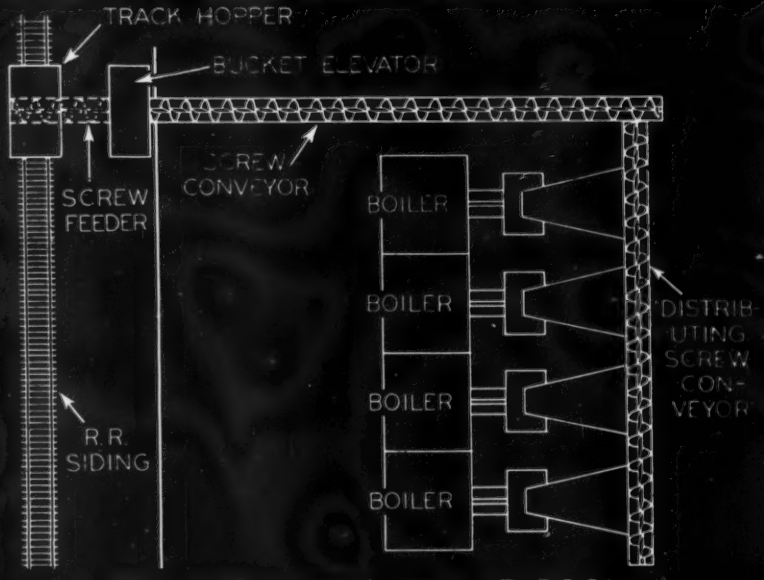
Stokers



Car Dumper

Weigh Larry

CUTTING COSTS WITH CONVEYORS



PACKING PLANT BOILER ROOM

The Boiler Room Was a "Gold Mine"

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DETROIT

NOTE to plant men who need to cut expense corners to combat high material and labor costs: your boiler room may be a "gold mine" for savings.

With the packing plant boiler house coal handling layout shown above, a problem was solved by a combination of Link-Belt units. Through a screw feeder, bucket elevator, screw conveyor and distributing screw conveyor, coal is handled from gondola cars to stoker hoppers. The services of only one man are required for unloading and maintenance. There is no coal dust problem.

The best team efficiency occurs when each man is a star at his own position. On the Link-Belt conveyor team are stars for any conveyor function, with a top-flight coach (the Link-Belt engineering department), to coordinate the overall result. Link-Belt makes Screw Conveyors . . . Bulk-Flo Elevator-Conveyors . . . Overhead Trolley Conveyors . . . Bucket Elevators . . . Skip Hoists . . . Belt Conveyors . . . The Sidekar-Karrier . . . Apron Conveyors . . . The Peck Carrier . . . Flight Conveyors . . . and many others.

Let us develop an efficient low-cost solution to your coal handling problem.

LINK-BELT COMPANY 10,547

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

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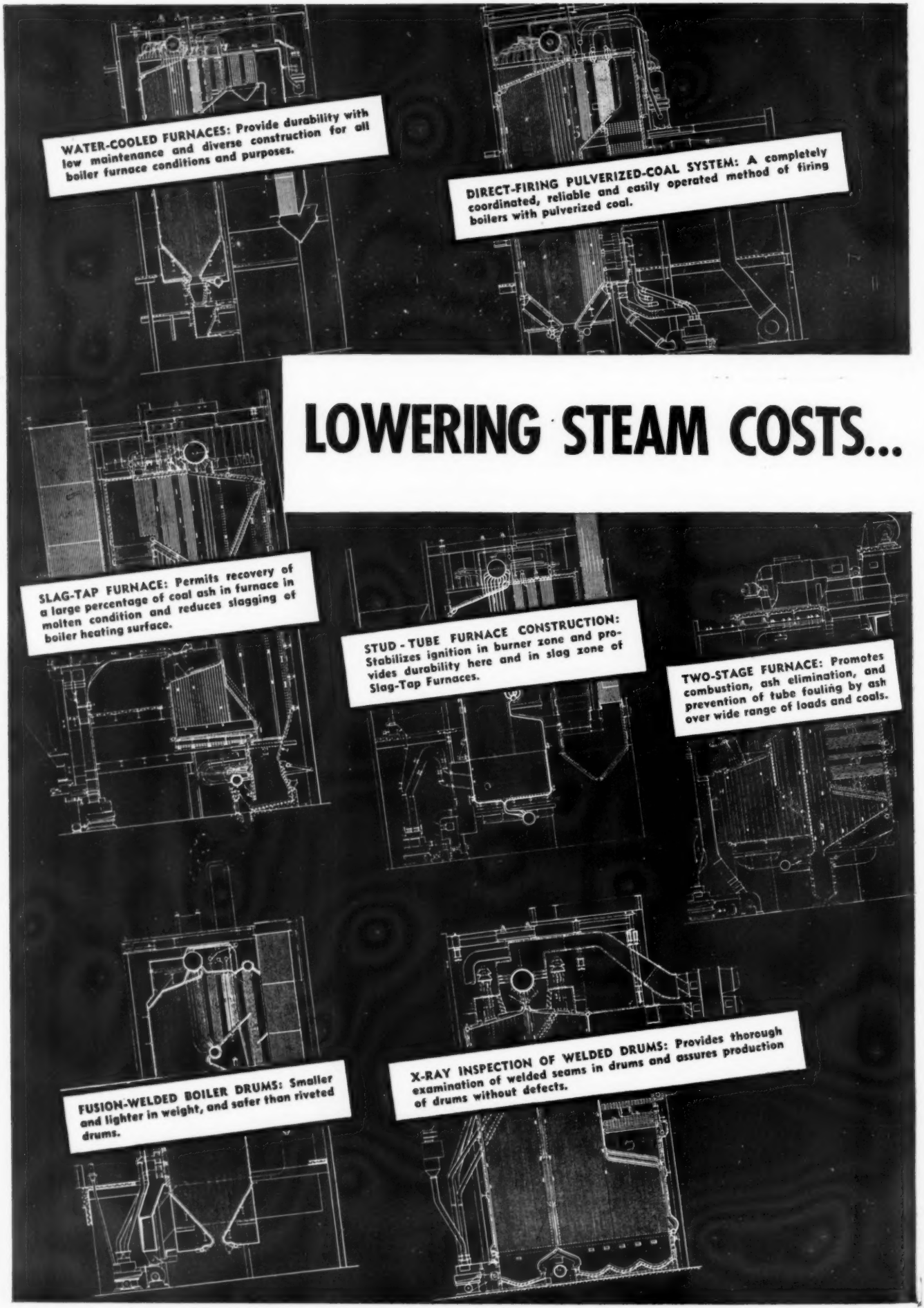
THE SYMBOL OF QUALITY — LB — LINK-BELT

COAL AND ASHES HANDLING EQUIPMENT


WATER-COOLED FURNACES: Provide durability with low maintenance and diverse construction for all boiler furnace conditions and purposes.
DIRECT-FIRING PULVERIZED-COAL SYSTEM: A completely coordinated, reliable and easily operated method of firing boilers with pulverized coal.
LOWERING STEAM COSTS...
SLAG-TAP FURNACE: Permits recovery of a large percentage of coal ash in furnace in molten condition and reduces slagging of boiler heating surface.
STUD-TUBE FURNACE CONSTRUCTION: Stabilizes ignition in burner zone and provides durability here and in slag zone of Slag-Tap Furnaces.
TWO-STAGE FURNACE: Promotes combustion, ash elimination, and prevention of tube fouling by ash over wide range of loads and coals.
FUSION-WELDED BOILER DRUMS: Smaller and lighter in weight, and safer than riveted drums.
X-RAY INSPECTION OF WELDED DRUMS: Provides thorough examination of welded seams in drums and assures production of drums without defects.

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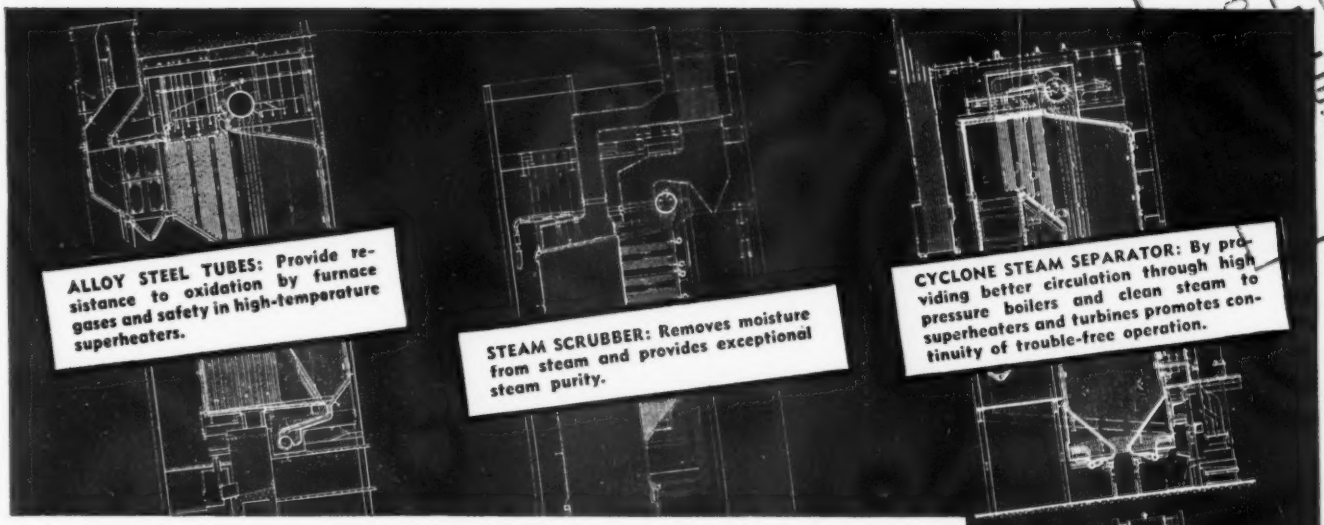
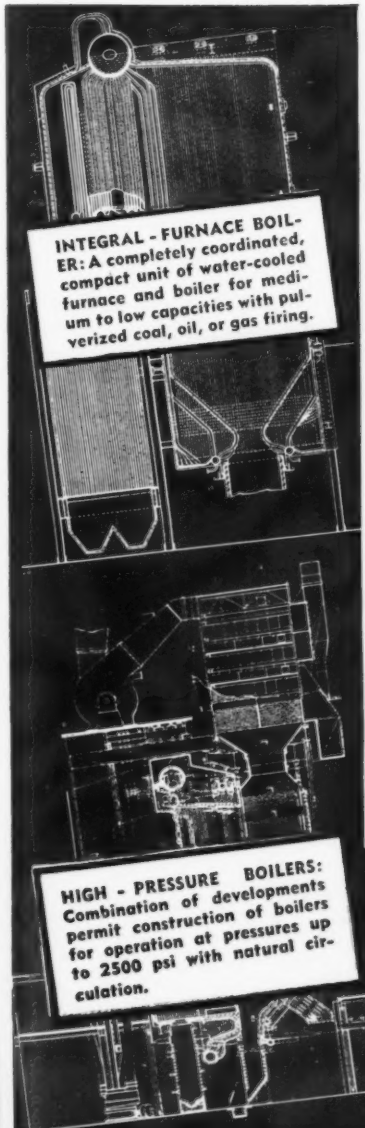


ALLOY STEEL TUBES: Provide resistance to oxidation by furnace gases and safety in high-temperature superheaters.

STEAM SCRUBBER: Removes moisture from steam and provides exceptional steam purity.

CYCLONE STEAM SEPARATOR: By providing better circulation through high pressure boilers and clean steam to superheaters and turbines promotes continuity of trouble-free operation.

AN OLD STORY WITH B&W



INTEGRAL - FURNACE BOILER: A completely coordinated, compact unit of water-cooled furnace and boiler for medium to low capacities with pulverized coal, oil, or gas firing.

HIGH - PRESSURE BOILERS: Combination of developments permit construction of boilers for operation at pressures up to 2500 psi with natural circulation.

INSTALLATION of the first B&W boiler eighty years ago marked the beginning of a new era in *safer, more efficient,* and *more reliable* steam generation. Ever since then, B&W has worked relentlessly with power engineers to push back the frontiers of progress . . . to reach the high standards of efficiency and economy attained in modern steam generation. Contributing importantly to this progress were the major boiler developments noted on these pages . . . all initiated and developed by B&W research and engineering, and perfected through teamwork with power plants. Today these pioneering accomplishments are accepted boiler practice for central stations and industrial power plants . . . all important factors in reducing steam costs to present low levels. In the future, as for the past 80 years, power men can continue to turn to B&W with confidence of getting the last word in boiler progress.

B&W OPEN - PASS BOILER: An efficient arrangement of furnace and heating surface for restricted headroom applications.

B&W RADIANT BOILER: An economical compact arrangement of furnace and heating surface for high-pressure, high-capacity units.

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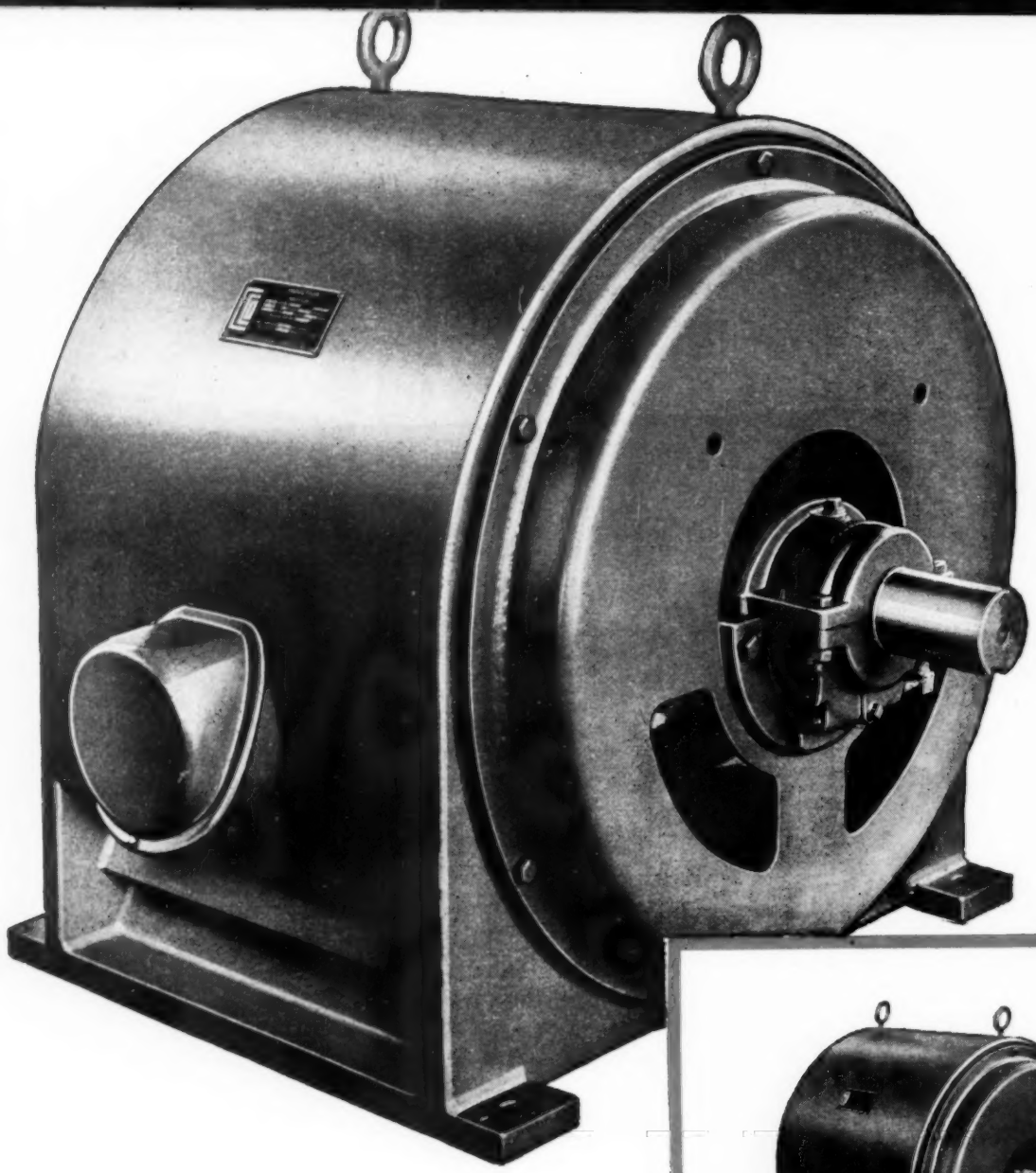

ACCESSIBLE—take off the bearing cap—and there's you bearing! You can lift off the top half, then take the weight of th rotor off the bottom half and roll that out too.

Elliott

FABRI

"threw away the book"

and came out with a better motor!

TRADITION says cast iron for motor enclosures—but Elliott advanced welding technique says STEEL—because of its rigidity, its tough, crack-proof strength, its workability, its lightness. This decision, once made, enabled Elliott designers, to plunge with enthusiasm into the job of developing a new standardized line of motors. Unhampered by the ball-and-chain of outmoded material limitations, they were able to incorporate ideas which had never before appeared in large motors. . . . Split sleeve bearings made exceptionally easy to get at. . . . Greater uniformity in air gap, assured by jigged-up precision machining and drilling of stator end plates and bearing brackets, and integral rigid stator assembly. . . . Positive, **directed** ventilation without recirculation. . . . Streamlined design, beautiful in appearance, saving 25% in space over former designs. . . . A 30% weight saving in the bearing bracket alone — 10% saving over the entire motor. These are just a few of many features that mean quieter, smoother performance and simplified maintenance.

150 to 1000 hp; four to fourteen poles; drip-proof, splash-proof, force-ventilated, pipe or base-ventilated. Bulletin on request.

ELLIOTT COMPANY
Electric Power Dept., RIDGWAY, PA.
Plants at: JEANNETTE, PA. • RIDGWAY, PA.
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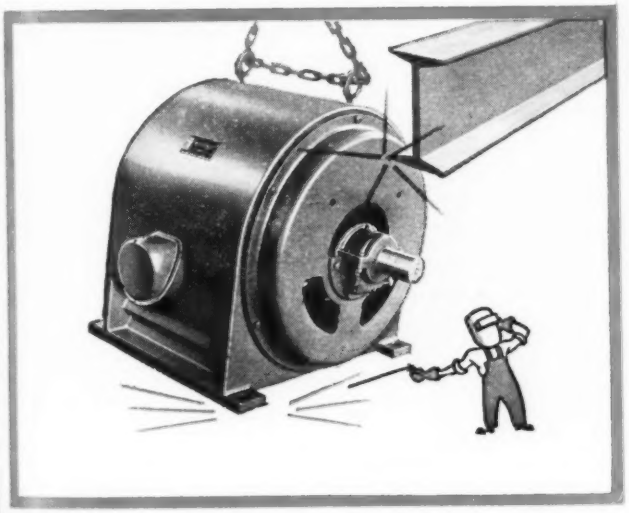
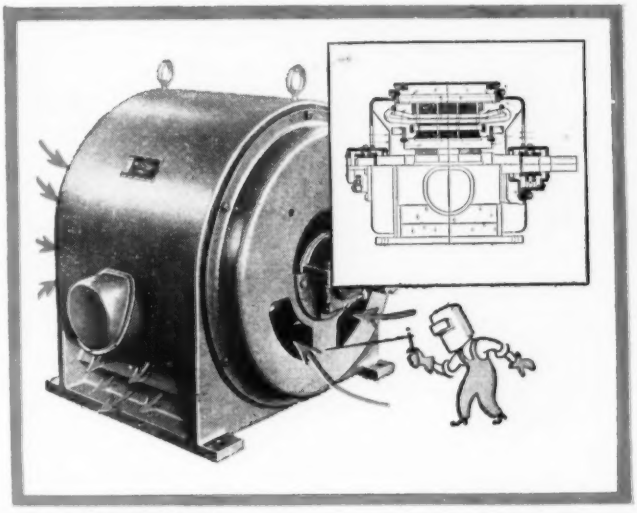


TOUGH — no fear of cracking a bearing bracket or breaking off a foot, with this all-steel motor. Rigid too, with the built-up, unyielding stiffness of fabricated steel.



COOL-RUNNING — because of **directed** air-flow, driven by radial fan and guided around and through rotor and stator, then out, taking heat with it. No recirculation.

L-778

STEEL Motors

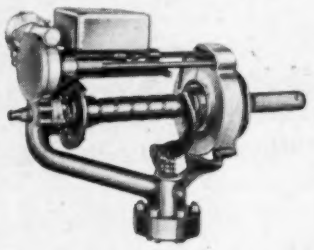
Typical Central Stations Installed and

Compiled by S G A Skrotzki
Associate Editor

Company	Location	Plant Name	Consulting Engineers	BOILERS
1100 PSI AND ABOVE				
Consolidated Edison Co of N Y	Manhattan, NYC, N.Y.	Waterside No. 1		
Public Service Elec & Gas Co	Sewaren, N. J.	Sewaren		
Long Island Lighting Co	Port Jefferson, N. Y.		Ebasco Services	
1000 TO 1099 PSI				
Atlantic City Electric Co	Atlantic City, N. J.	Missouri Ave	Amer Gas & Elec Serv	
Ohio Power Co	Brilliant, Ohio	Tidd	Amer Gas & Elec Serv	
The Cincinnati Gas & Elec Co	Cincinnati, Ohio	West End		
Public Service Elec & Gas Co	Newark, N. J.	Essex		
New Jersey Power & Light Co	Milford, N. J.	Gilbert	Gilbert Associates	
Loup River Public Power Dist	Bellevue, Neb.	Bellevue	Sargent & Lundy	
Buffalo-Niagara Elec Corp	Buffalo, N. Y.	C R Huntley		
Central New York Power Corp	Oswego, N. Y.	Oswego		
New Orleans Public Service, Inc	New Orleans, La.	Industrial Canal	Ebasco Services	
Rochester Gas & Elec Corp	Greece, N. Y.	Lakeside	Gilbert Assoc	
West Penn Power Co	Courtney, Pa.	Mitchell	Sanderson & Porter	
Commonwealth Edison Co	Chicago, Ill.	Fisk	Sargent & Lundy	
Boston Edison Co	Everett, Mass.	Mystic	Jackson & Moreland	
Gulf States Utilities Co	Lake Charles, La.	Riverside	Sanderson & Porter, Stone & Webster	
900 TO 999 PSI				
Florida Power & Light Co	Riviera, Fla.	Riviera	Ebasco Services	
Consumers Power Co	Essexville, Mich.	John C Weadock	Commonw & South	
Consumers Power Co	Muskegon, Mich.	B C Cobb	Commonw & South	
Consumers Power Co	Comstock, Mich.	Bryce E Morrow	Commonw & South	
Central Illinois Pub Serv Co	Meredosia, Ill.	Meredosia	Sargent & Lundy	
Texas Electric Service Co	Handley, Tex.	Handley	Ebasco Services	
Pennsylvania Electric Co	Warren, Pa.	Warren	Gilbert Associates	
Gulf Power Co	Pensacola, Fla.	Pensacola	Commonw & South	
Mississippi Power Co	Hattiesburg, Miss.	Eaton	E C Gaston	
The Connecticut Light & Pwr Co	Devon, Conn.	Devon		
Philadelphia Electric Co	Philadelphia, Pa.	Southwark		
Cons Gas, Elec Lt & Pwr Co Balt	Turner, Md.	Riverside		
The Detroit Edison Co	Marysville, Mich.	Marysville		
Houston Ltg & Power Co	near Houston, Tex.	West Junction	Ebasco Services	
So California Edison Co	Redondo Beach, Calif.	Redondo	Stone & Webster	
Indianapolis Pwr & Lt Co	Indianapolis, Ind.	Harding St	Gibbs & Hill	
Indianapolis Pwr & Lt Co	near Martinsville, Ind	White River	Gibbs & Hill	
The Potomac Edison Co	Williamsport, Md.	Williamsport	Sanderson & Porter	
Central Arizona Lt & Pwr Co	Phoenix, Ariz.	Phoenix	Ebasco Services	
The United Illuminating Co	New Haven, Conn.	English	Westcott & Mapes	
San Diego Gas & Elec Co	San Diego, Calif.	Silver Gate	P U E & S Corp	
Staten Island Edison Corp	Travis, N. Y.	Arthur Kill	Gilbert Assoc	
Central Power & Light Co	Corpus Christi, Tex.	Nueces Bay	Sargent & Lundy	
Florida Power Corp	Enterprise, Fla.	Benson Springs	J G White Eng Corp	
Florida Power Corp	Inglis, Fla.	Inglis	J G White Eng Corp	
Southwestern Gas & Elec Co	Mooringsport, La.	Lieberman	Sargent & Lundy	
Iowa-Illinois Gas & Elec Co	Davenport, Ia.	Riverside	United Lt & Rwys	
N Y State Elec & Gas Corp	Corning, N. Y.		Gilbert Associates	
Interstate Power Co	Lansing, Ia.	Lansing	Sargent & Lundy	
Pub Serv Co of Colorado	Denver, Col.	Lacombe	Electric Advisers	
South Carolina Power Co	Charleston, S. C.	Hagood	Commonw & South	
Ohio Public Service Co	Lorain, Ohio	Edgewater	Electric Advisers	
800 TO 899 PSI				
Kansas City Pwr & Lt Co	Kansas City, Mo.	Grand Ave	United Lt & Rwys	
Pennsylvania Electric Co	Indiana County, Pa.	Seward	Gilbert Associates	
Sioux City Gas & Elec Co	Sioux City, Ia.	Kirk		
Potomac Electric Power Co	Penning, D. C.	Benning	Stone & Webster	
Southern Colorado Pwr Co	Pueblo, Colo.	Pueblo	P U E & S Corp	
Wisconsin Pub Serv Corp	Green Bay, Wis.	Bayside	P U E & S Corp	
Central Power & Light Co	San Benito, Tex.	La Palma	Sargent & Lundy	
Dallas Power & Light Co	Dallas, Tex.	Mountain Creek	Ebasco Serv	
Eastern Shore Pub Serv Co of Md	Vienna, Md.	Vienna	United Eng & Const	
The United Illuminating Co	Bridgeport, Md.	Steel Point	Westcott & Mapes	
West Texas Utilities Co	Abilene, Tex.	Abilene	Sargent & Lundy	
Imperial Irrigation District	El Centro, Calif.	El Centro	Gibbs & Hill	
Central Louisiana Elec Co	St. Landry, La.	Coughlin	Sargent & Lundy	
Northwestern Pub Serv Co	Mitchell, S. D.	Mitchell	Sargent & Lundy	
400 TO 599 PSI				
Omaha Public Power Dist	South Omaha, Neb.	South Omaha		
Mt. Carmel Pub Utility Co	Mt. Carmel, Ill.	Mt. Carmel		
Sheridan County Electric Co	Sheridan, Wyo.	Acme		
Peoples Gas & Electric Co	Mason City, Ia.	Mason City		
Florida Power & Light Co	Lake Monroe, Fla.	Sanford	Ebasco Serv	
Missouri Utilities Co	Poplar Bluff, Mo.	Poplar Bluff	Black & Veatch	

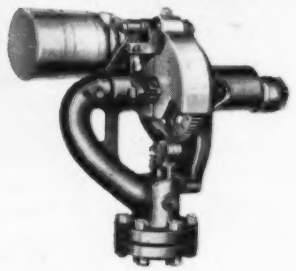
A	—Air coolers	*CE*	—Combustion Engineering Co	*EM*			
AAlu	—Arsenical Aluminum brass	*CG*	—Chain grate	*FW*			
AAd	—Arsenical Admiralty	*Cr*	—Crushed coal, cyclone burner	*G*			
Alu	—Aluminum bronze	*Cu*	—Copper	*GE*	—Ge		
Alu	—Aluminum brass	*Du*	—Dual drive	*H*	—Hy		
AC	—Allis-Chalmers Mfg Co	*Da*	—Damper	*Hy*	—Hy		
Ar	—Arsenical copper	*DB*	—Dry bottom	*IAd*	—Inhibited Admiralty metal	*O*	—Oil
Ad	—Admiralty	*DT*	—Downtherm system	*L*	—Lignite	*P*	—Pulverized-fuel firing
BW	—Babcock & Wilcox Co	*Du*	—Duplex drive	*La*	—Louvre	*PAd*	—Phosphorised admiralty
C	—Coal, bituminous	*EC*	—Erie City Iron Works	*M*	—Motor drive	*Pl*	—Plate
CA	—Coal, anthracite	*Ell*	—Elliott Co	*Mo*	—Magnetic coupling		

DIAMOND Model IR Short Retracting Soot Blowers



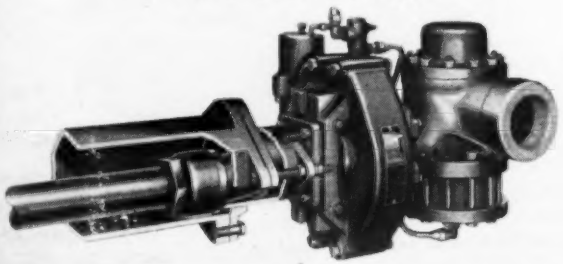
Air operation shown; also manual or electric operation. Cleaning medium either steam or air.

DIAMOND Model G98 Soot Blower



Electric operation shown; manual or air operation also available. Cleaning medium is steam.

DIAMOND Model A2E Automatic Air Puff Soot Blowers



Head for large air flow rates shown; smaller head for lower flow rates also available.

DIAMOND POWER SPECIALTY CORP.

Planned Since September 1946

F-D FANS	I-D FANS		FUEL			FEED PUMPS		TURBINES						CONDENSERS				
								kw			psia	Points	oiling	sq ft			Capacity Lb. 1000 lb	ler Capacity Lb. 1000 lbs

LIST PUBLISHED IN POWER JUNE, 1947

83% of the Soot Blowers for These Plants Are DIAMOND SOOT BLOWERS

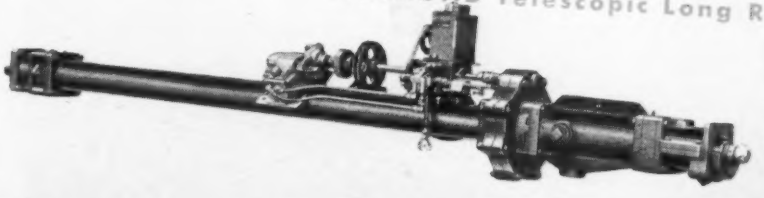
Here is further evidence of the continuing overwhelming preference for Diamond Soot Blowers among engineers responsible for the selection of equipment for central stations where requirements are most severe. The 83% includes all types of Diamond soot blower installations . . . from completely automatic sequential systems (using air and/or steam as the cleaning medium with air or/and electric control) to manually operated individual blowers. There are Diamond Soot Blowers to exactly meet your individual needs.

Ask for new catalog No. 1014.

DIAMOND Model IK Long Retracting Soot Blowers

Air operation shown; electric operation also available. Cleaning medium either air or steam.

DIAMOND Telescopic Long Retracting Soot Blowers

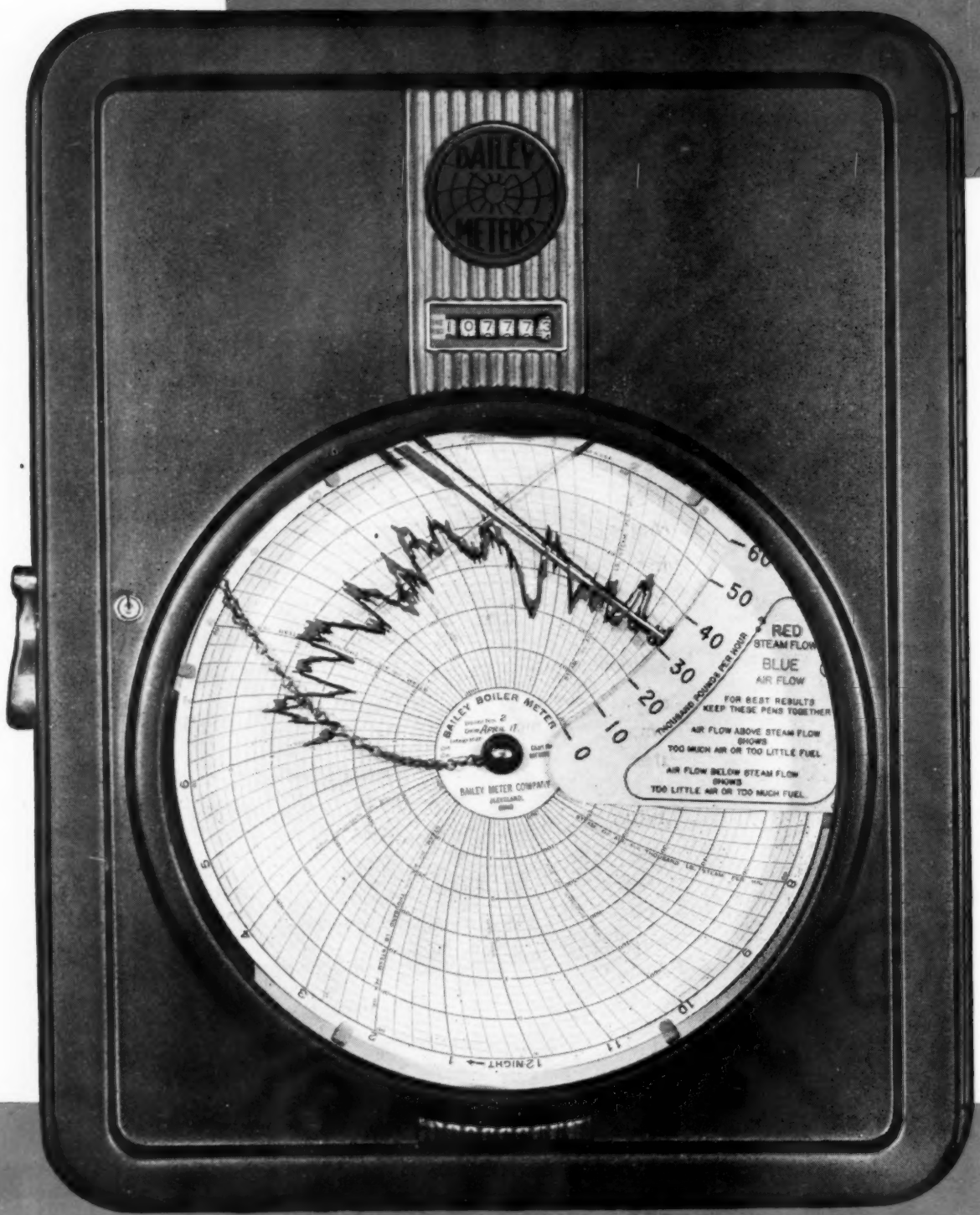


Air operation shown; also electric operation. Uses air or steam as cleaning medium.

WE —Westinghouse Electric Corp
(150) —Stoker grate area, sq ft
1—New l-p turbines taking exhaust from topping turbines
7—Two units
8—Cross compound; h-p 3600; l-p 1800
9—Gas 1070 Btu per cu ft
10—Gas, 1040 Btu per cu ft
17—Two units, 7,500 kw each
18—Continuous ash discharge
19—Oil and gas standby
20—Boiler ready Aug 1947

DETROIT 31, MICH. • DIAMOND SPECIALTY LIMITED—Windsor, Ontario

Whatever Fuel



Bailey Controllers of this type accurately measure and record the factors upon which controls are based.

You Burn—You'll Save Money with BAILEY CONTROLS

You'll get high Economy, Safety and Availability because Bailey Controls, working from the accurate measurements of Bailey Meters, do the right thing at the right time.

Bailey Combustion Control

1. Secures instant response to changes in load by regulating both fuel and air at the same time.
2. Maintains optimum fuel-air ratio as measured by Bailey Meters.
3. Gives you the same complete control, when you change fuel, or even when you burn waste.

Bailey Three-element Feed Water Control

1. Reacts quickly and yet retains high stability by accurately measuring Steam Output and Feed Water Input and by controlling the rate of feed water input so that it equals steam output.
2. Surge resulting from severe load changes is held to a minimum by the action of flow ratio and level components which may be adjusted to conform with boiler characteristics and operating conditions.
3. Needs no excess pressure control because its operation is based in part on an accurate measurement of feed water input.
4. Power used by feed pumps may be reduced by applying Three-element Feed Water Control directly to pump speed.

Bailey Steam Temperature Control

Maintains uniform temperature by controlling primarily from boiler load and by readjusting from temperature.

Bailey Feed Heater Control

1. Gives smooth efficient flow through heaters because its multi-element action incorporates accurate measurements of both flow and level.
2. Permits the use of smaller storage capacity heaters and tanks thereby reducing the cost of initial equipment.

Bailey Pump By-Pass Control

Protects pumps by opening a by-pass valve when flow through the pump drops below the safe minimum value.

BAILEY METER COMPANY

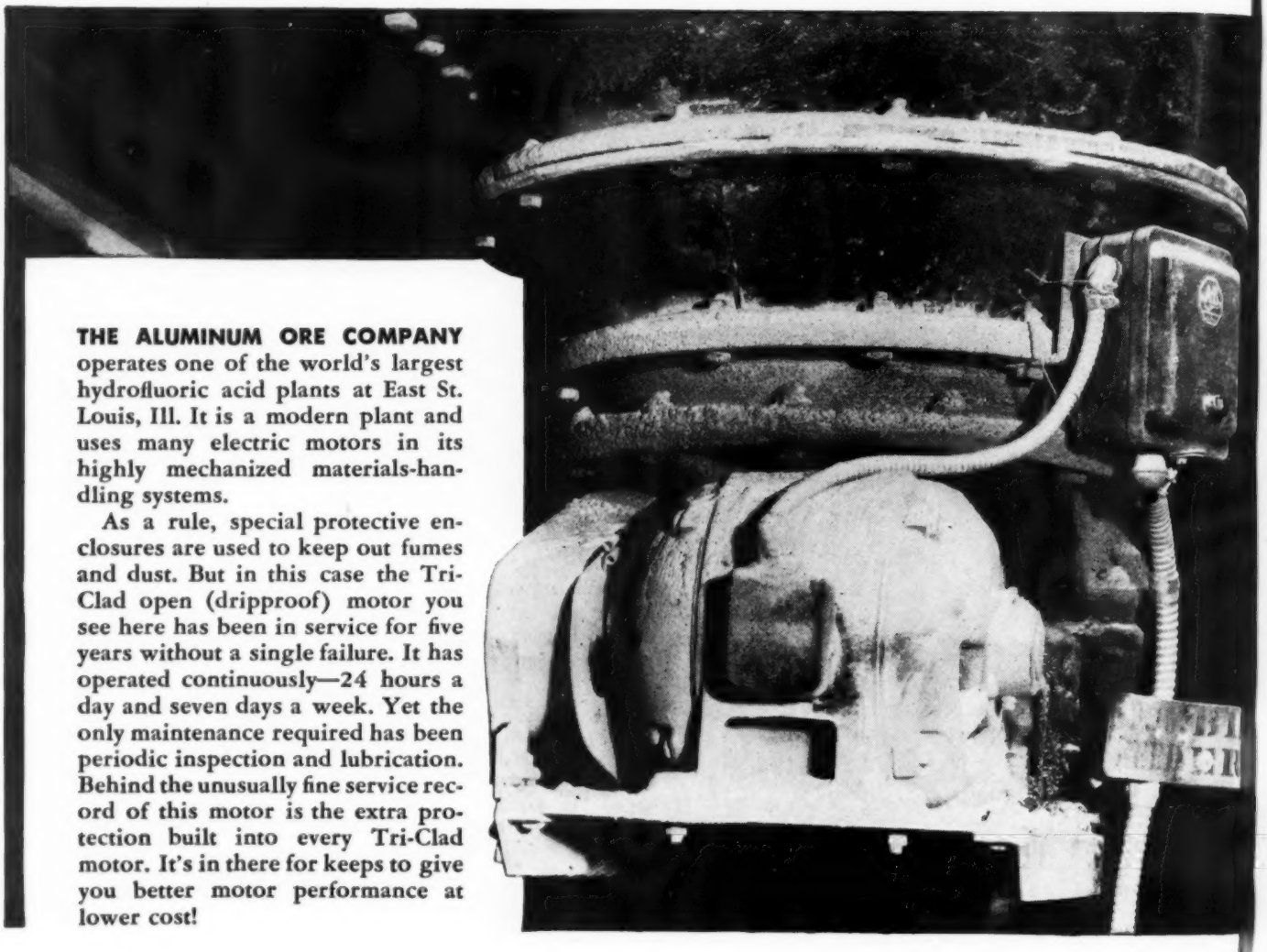
1036 IVANHOE ROAD • • • CLEVELAND 10, OHIO

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

A-99

4 MILLION HP



THE ALUMINUM ORE COMPANY operates one of the world's largest hydrofluoric acid plants at East St. Louis, Ill. It is a modern plant and uses many electric motors in its highly mechanized materials-handling systems.

As a rule, special protective enclosures are used to keep out fumes and dust. But in this case the Tri-Clad open (dripproof) motor you see here has been in service for five years without a single failure. It has operated continuously—24 hours a day and seven days a week. Yet the only maintenance required has been periodic inspection and lubrication. Behind the unusually fine service record of this motor is the extra protection built into every Tri-Clad motor. It's in there for keeps to give you better motor performance at lower cost!

The toughest TRI-CLAD ever built!

Newest addition to the Tri-Clad motor family is the Tri-Clad totally enclosed, fan-cooled motor. It is designed for use in adverse atmospheres—in iron dust, out-of-doors, in hazardous areas, and chemical atmospheres. Available in both standard and explosion-proof types, this motor gives you these important construction features:

- A cast-iron, double-wall frame which completely encloses and protects the windings and punchings.
- A non-shrinking compound around motor leads which protects motor interior from dust and moisture.
- A rotating labyrinth seal which further protects the motor interior from damage by foreign matter.

CONFIRMS IT!

FOR TOUGH MOTOR JOBS, YOU CAN'T BEAT

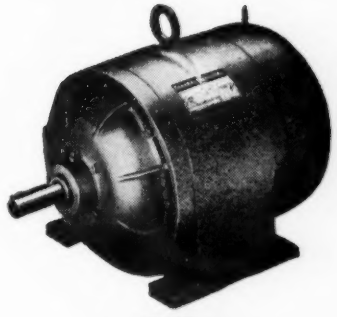
TRI CLAD

EXTRA PROTECTION

To date, a million and a half Tri-Clad motors, with a total output of over 4-million horsepower, have been purchased by American industry!

In every kind of plant from steel mill to dairy, these motors are proof beyond doubt that you can't beat Tri-Clad extra protection for tough motor applications. Even on jobs where special protective enclosures would ordinarily have been specified, Tri-Clad open motors, applied during the war years, have stood up to heat, dust, and dampness, operating smoothly and efficiently for years with only minimum maintenance.

Today, the Tri-Clad family includes many different types and sizes. But whatever your selection, the Tri-Clad motor nameplate is still your best assurance of a high return on your motor dollar. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*



EXTRA PROTECTION . . . **AGAINST PHYSICAL DAMAGE!**

Rigid cast-iron frame and end shields protect vital motor parts from external abuse. Because they're not at the mercy of a coat of paint, they strongly resist chemical attack and dampness. Cast iron also gives you wide nonyielding metal fits between end shields and frame for ease of assembly.

EXTRA PROTECTION . . . **AGAINST ELECTRICAL BREAKDOWN!**

Motor windings of Formex* wire, together with improved insulating materials, reduce the chances of electrical failure. Heat is dissipated quickly—motor stays young for years and years!

EXTRA PROTECTION... **AGAINST OPERATING WEAR AND TEAR!**

Bearing design affords longer life, greater capacity, improved lubrication features. Bearing seals retain lubricant, keep out dirt. One-piece, cast-aluminum rotor is practically indestructible.

*Trade-mark reg. U.S. Pat. Off.

GENERAL ELECTRIC

750-287

TRI CLAD

REG. U.S. PAT. OFF.

MOTORS

- OPEN (DRIPPROOF)
- TOTALLY ENCLOSED
- EXPLOSION-PROOF

LET IT RAIN! LET IT SNOW!

It's a fact! Feed the Æ Perfect Spread Stoker any grade of coal and watch it operate perfectly—without clogging, whether your coal supply is wet, dry, or partially frozen. This and many other operating features are exclusive with Perfect Spread and are not available in any other stoker.

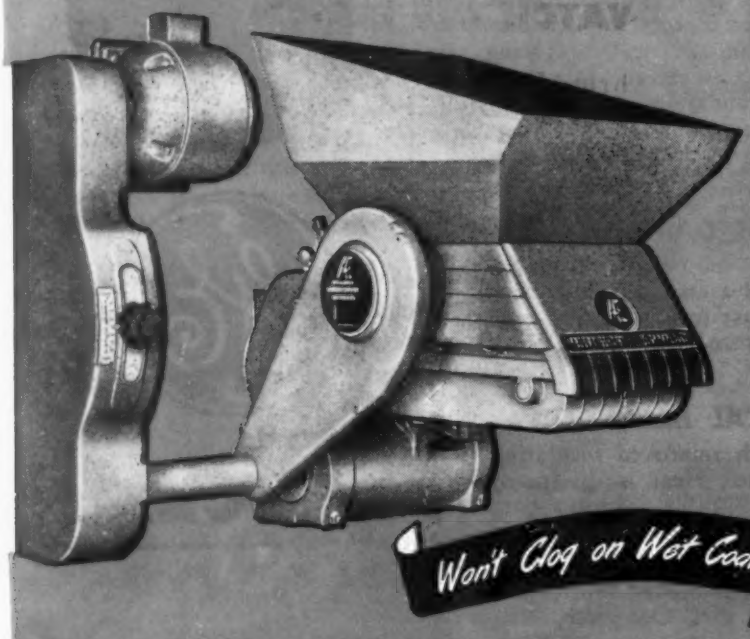
But "the proof of the pudding is in the eating." With scores of Perfect Spread Stokers in operation and production going full speed to satisfy the large number of orders promptly, it is evident that the Æ Perfect Spread Stoker is accepted as a highly efficient and economical stoker. Before buying any fuel firing equipment, investigate! Write for descriptive booklet today!

WET COAL WON'T CLOG

PERFECT SPREAD STOKER

WITH TRAVELING, DUMPING OR STATIONARY GRATES

THIS STOKER



Won't Clog on Wet Coal!

The Perfect Spread Stoker has a record of proved economy and cost-cutting efficiency in many industries—over an 18-year period.

Æ

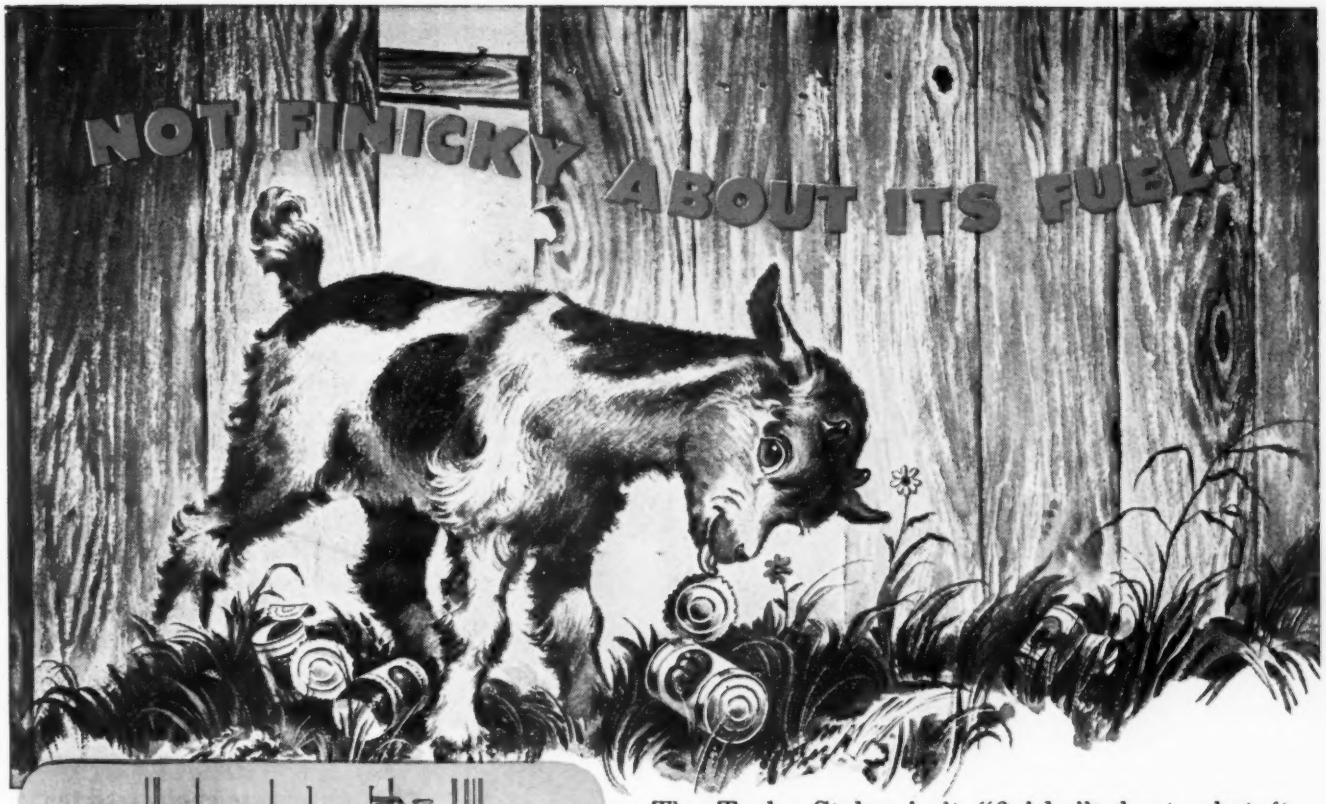
FREE—Get this valuable descriptive booklet on the Æ Perfect Spread Stoker today!

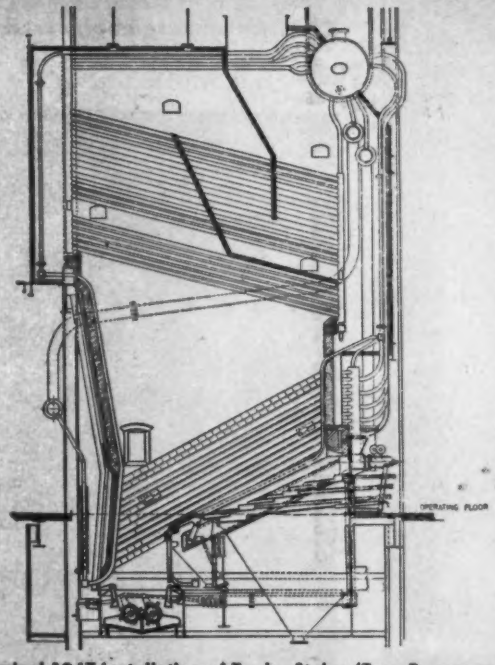
Address inquiries to 2400 Aramingo Ave., Philadelphia 25, Pa.

Other Æ Products: Æ-TAYLOR STOKERS, LO-HED HOISTS MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER

AMERICAN ENGINEERING COMPANY

2400 ARAMINGO AVENUE, PHILADELPHIA 25, PA.





A typical 1947 installation of Taylor Stoker (Type R—capacity 240,000 lb./hr.) in a large U. S. Govt. heating plant.

The Taylor Stoker isn't "finicky" about what it consumes—its fuel-flexibility permits the use of a variety of types and sizes of coal, whatever is convenient for YOU from the standpoint of price, labor, delivery, mine location and any other cost lowering considerations you may have.

Cut combustion costs the Taylor Stoker Way. It's the fuel-flexible economy stoker.

WATCH THE TREND!

Throughout industry wherever underfeed stokers are discussed Taylor is first mentioned —the buyer's choice on original and repeat installations. That means *proved* performance.

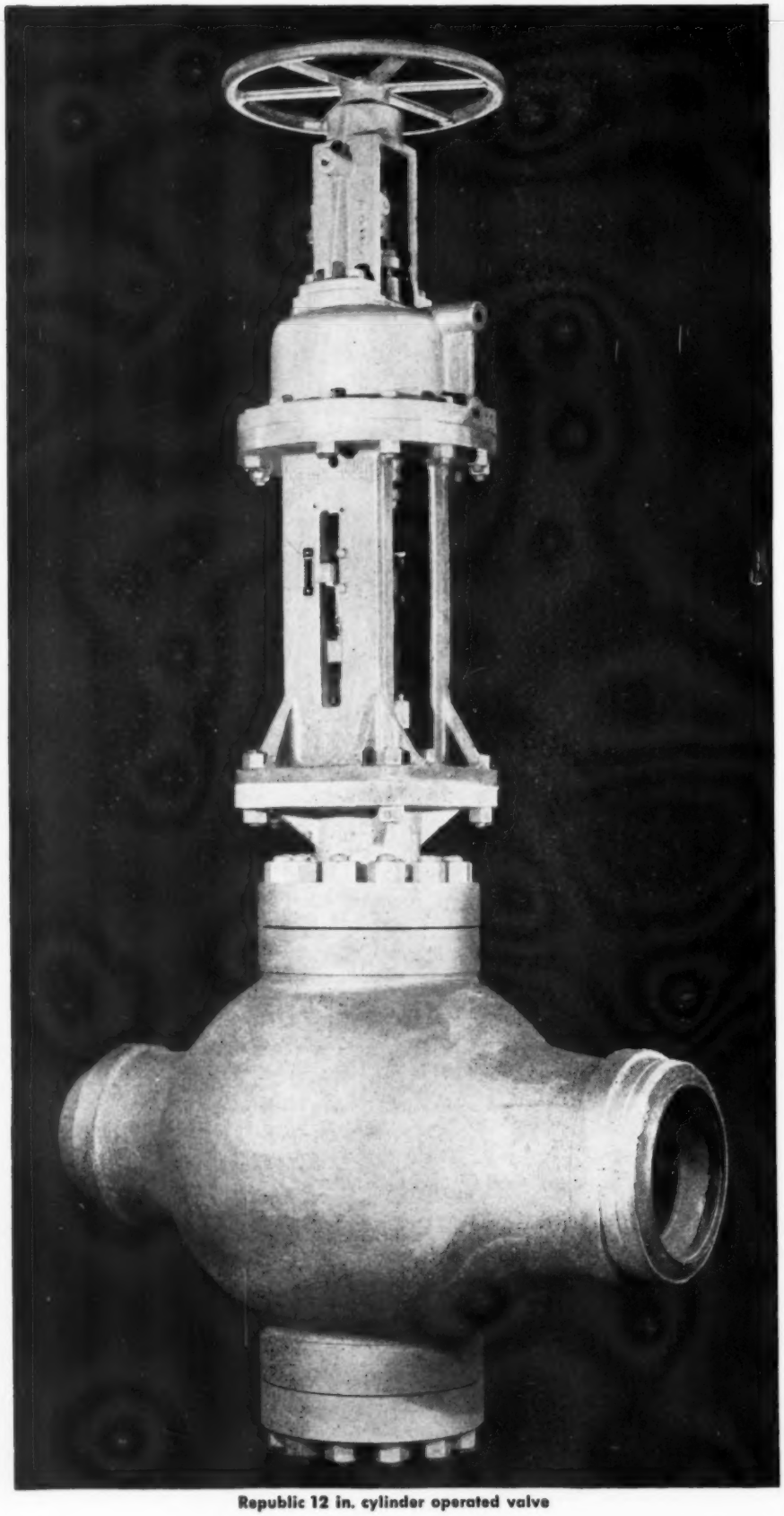
UP-TO-DATE FACTS ON THIS IMPROVED TAYLOR STOKER

If you aren't up to the minute on Stokers, get your copy of this booklet. Write to Department 24 today!

TAYLOR STOKER

AMERICAN ENGINEERING COMPANY

2400 ARAMINGO AVENUE, PHILADELPHIA 25, PA.

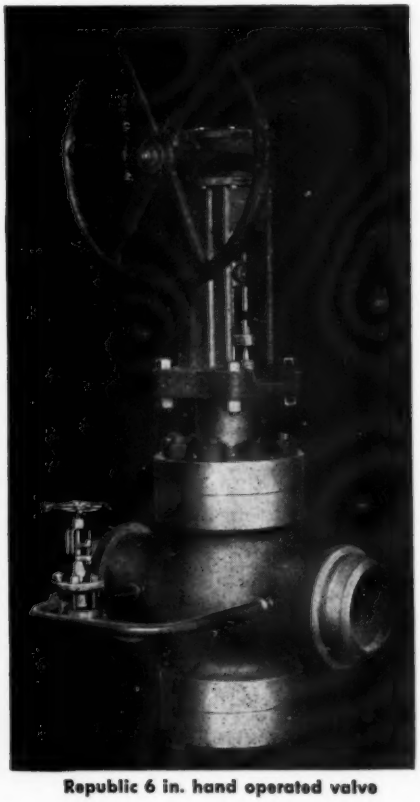


Republic 12 in. cylinder operated valve

REPUBLIC

GENERAL SPECIFICATIONS

- Built in all pressure standards—both flanged and welded ends.
- Streamlined flow through parts virtually eliminates erosion.
- Single seated valves—guaranteed drop tight.
- Double seated valves—guaranteed maximum leakage less than 1/2%.
- Steam valves have heat treated stainless steel trim with screwed in seats.
- Water valves have welded in seat rings with hard surface overlay—on small valves overlay is made directly on body.
- All valves are engineered to the job or application.



Republic 6 in. hand operated valve

REPUBLIC FLOW METERS CO.

VALVES REPUBLIC

Regulating — Pressure Reducing — Shutoff

CYLINDER OPERATED—double seated

Republic cylinder operated valves are of the gradual opening, high lift, double seated type. They are hydraulicly operated to assure smooth performance at any speed regardless of size, static pressure or pressure reduction. These valves are available in sizes from 3″ to 24″, with or without hand operating wheel. Due to compact design, a regulator may be mounted directly on the valve.

HAND OPERATED—large sizes

Republic hand operated valves, in sizes from 3″ to 8″, are built to 900 lb. and 1500 lb. pressure standards. They are of the single seated type, have a one piece valve stem, and seat rings that are Stellite surfaced and welded in place. The gear reduction head is built with ball or roller bearings and precision ground gears for minimum friction and back lash. These valves are recommended for flow control and shutoff applications.

HAND OPERATED—small sizes

Republic single seated hand operated valves are also available in 1″, 1½″ and 2″ sizes, built to 600 lb., 900 lb. and 1500 lb. pressure standards. These valves also have a one piece valve stem, and a Stellite surfaced seat integral with the valve body.

LEVER OPERATED—large sizes

Republic double seated lever operated valves are ideal for air actuation with long stroke cylinders. They are available in sizes from 3″ to 16″ for low pressure applications and in sizes up to 6″ for 1500 lb. applications. The lever mechanism, of sturdy construction capable of taking full strains of power cylinders, is adjustable with full cylinder stroke to change valve capacity.

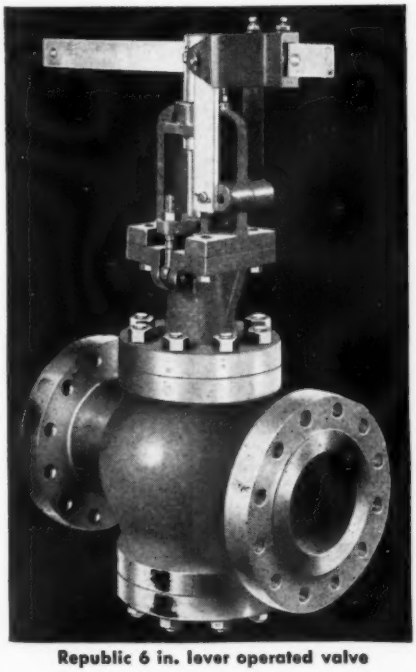
LEVER OPERATED—small sizes

Republic single seated lever operated valves are available in sizes up to 2″ and for pressures up to 1500 lb. standard. The valve seat is Stellite surfaced and integral with the valve body. The sturdy lever mechanism is adjustable for lift. Many of these valves are in operation on water lines with over 1000 lbs. pressure reduction.

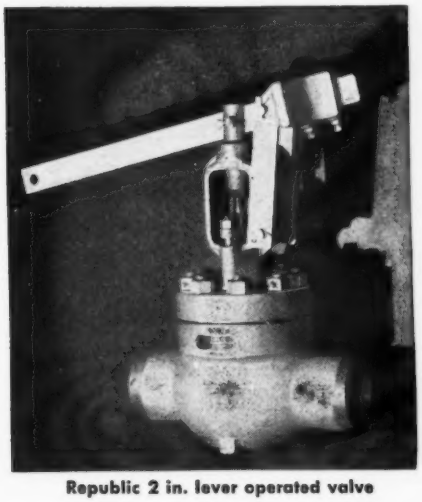
BUTTERFLY VALVES

Republic butterfly valves can be supplied in cast iron or steel for pressures up to 300 lbs. Vanes can be supplied of the angle seating or swing through types. The shaft can be mounted on ball or plain bearings as required. A valve operator may be mounted directly on valves of 6″ size and over.

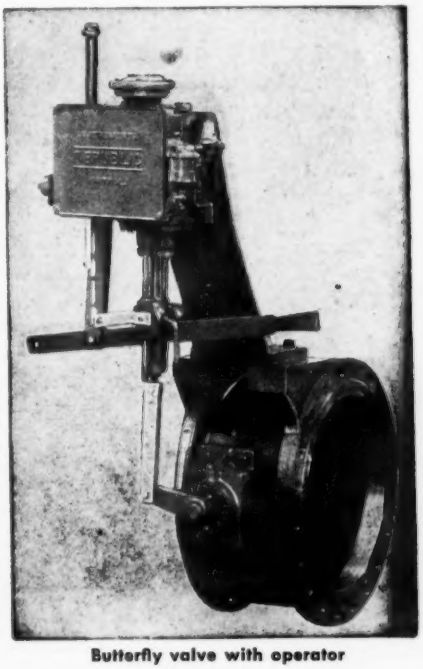
All Republic valves are engineered to the specific job on which they are to be used. Our engineers will be glad to consult with you on any of your valve problems. Write, asking to have one of our engineers call.



Republic 6 in. lever operated valve



Republic 2 in. lever operated valve



Butterfly valve with operator

2240 Diversey Pkwy., Chicago 47, Illinois

re-run savings paid for stokers

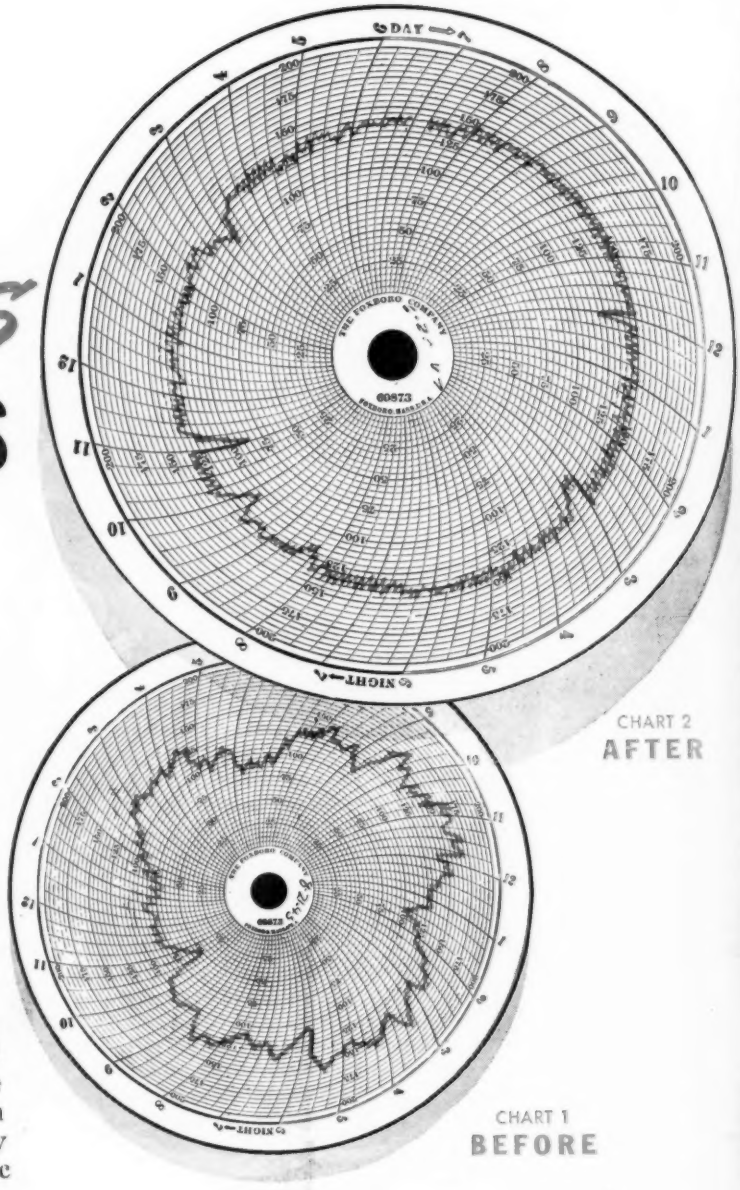


CHART 2
AFTER

CHART 1
BEFORE

The Taylor-Colquitt Company, of Spartanburg, S. C., are wood preservers, using a creosote impregnation process for poles, piles, ties and lumber. Process steam at constant pressure is a vital factor in securing impregnation to the desired depth. A pressure failure means a re-run for re-treating – and re-runs cost money.

Pressure Chart No. 1, illustrates the condition that caused frequent and expensive re-runs. To correct this, C-E Spreader Type stokers were installed under the existing HRT Boilers. What this meant in stabilizing steam pressures is dramatically illustrated by Pressure Chart No. 2.

Let J. D. Taylor, Plant Manager, tell the story: "The results obtained by this method of firing have been very satisfactory, and we have encountered practically no difficulty in maintaining a constant and satisfactory steam pressure. We are very enthusiastic about these stokers and take pleasure in recommending them. All automatic controls work perfectly and we are delighted with the results. Our processing has been much improved by being able to maintain a constant steam pressure at all times."

This was praise indeed. But, in addition, Combustion Engineering was informed by Taylor-Colquitt management that "re-treats" have been materially reduced since installing spreader stokers and that the stokers would *pay for themselves within a very few months.*

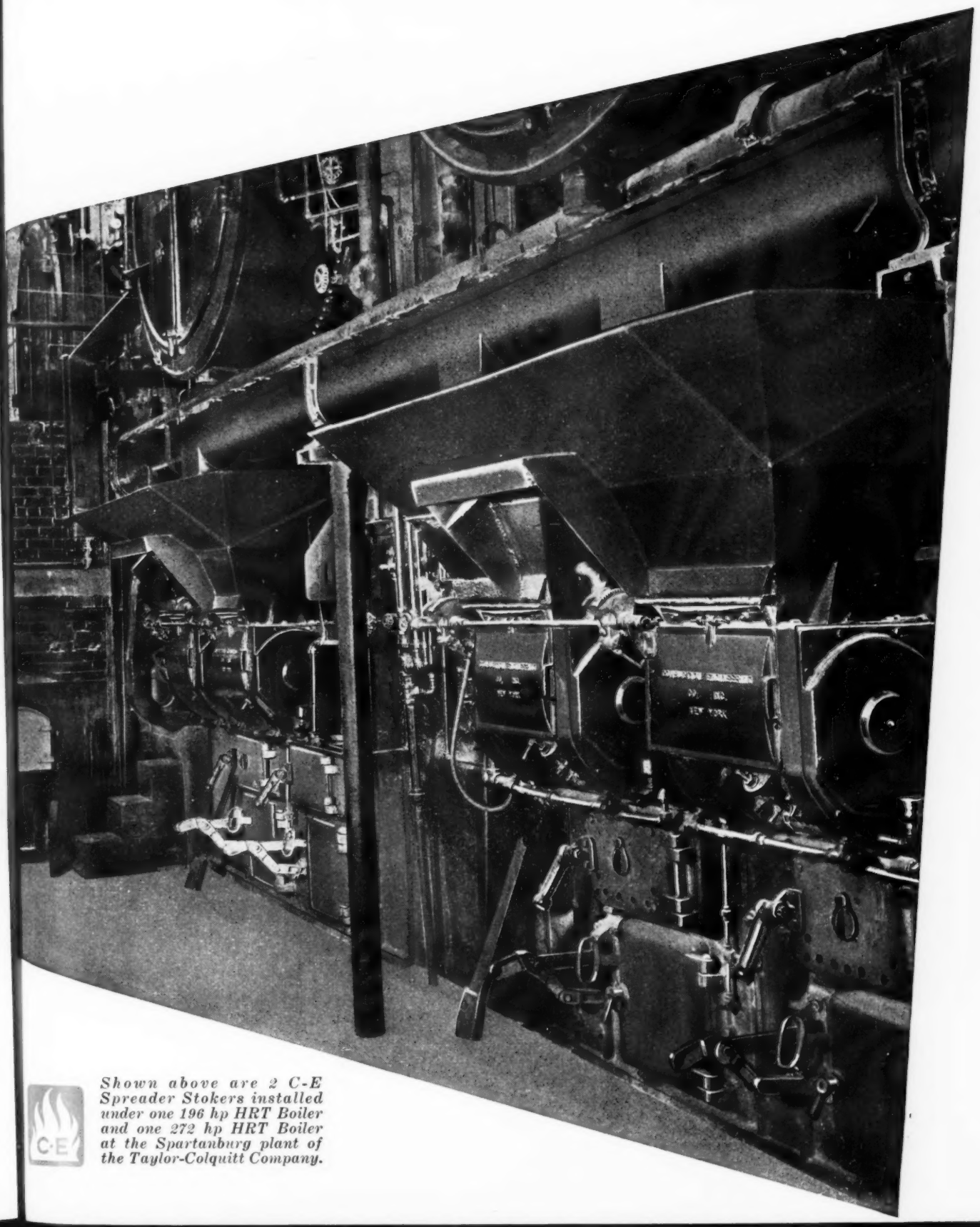
C-E is frank to acknowledge – and glad to credit – the exceptionally careful and intelligent operation of these stokers by Taylor-Colquitt operating personnel. And this combination of correctly designed equipment expertly operated is paying handsome dividends.

For hundreds of plants at home and abroad C-E spreader stokers have proved to be the one best answer to operating economy and efficiency. How about your plant? Our engineers will gladly work with yours to obtain the best solution, whatever your requirements may be.

B-173

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; ALSO MANY TYPES OF PRESSURE VESSELS



Shown above are 2 C-E Spreader Stokers installed under one 196 hp HRT Boiler and one 272 hp HRT Boiler at the Spartanburg plant of the Taylor-Colquitt Company.

ENGINEERING

200 MADISON AVENUE • NEW YORK 16, N. Y.

Simplify your
this handy *NEW*

Loads...hauls...spreads
...compacts with thrifty
ONE-MAN OPERATION

LETOURNEAU
LET

See your Le Tourneau Distributor
NOW for complete information

rcoal storage with
D TOURNAPULL

WHY GO to the extra expense of special one-purpose equipment for stockpiling coal, when you can do the job faster, easier, better with a D Tournapull — and at the same time gain a money-saving tool for general maintenance and clean-up work.

As a coal handler, this one-man Tournapull can move approximately 2 tons of coal per trip* . . . haul at average truck speeds . . . spread each load in smooth, shallow layers . . . compact coal without damage through cushioning action of big low-pressure tires.

Tournapull method of piling saves valuable storage space . . . minimizes danger of spontaneous combustion . . . permits greater flexibility because small stockpiles of coal can be maintained at locations most convenient for serving shops and equipment.

Get the facts on this versatile one-man coal handler today. Find out about its many other applications such as: grading building sites, leveling parking lots, handling cinders, graveling haul roads and open yard areas.

See your LeTourneau Distributor or write:

R. G. LeTOURNEAU, Inc., Peoria, Ill.

*Larger Tournapulls handle up to 16 tons of coal per trip.

Tournapull—Trademark Reg. U.S. Pat. Off. CH-2—1

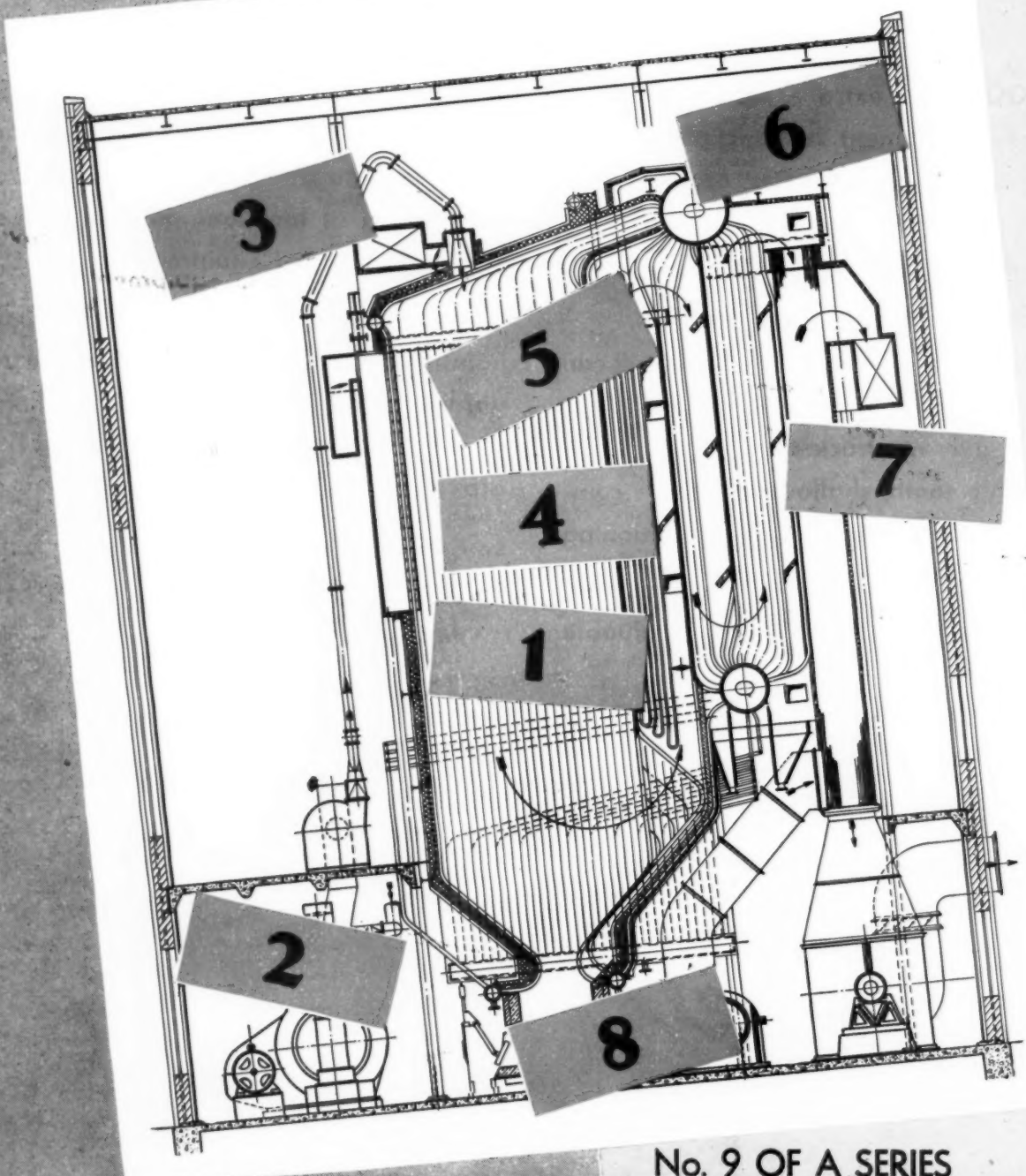
New D Tournapull hauls approximately 2 tons of coal per trip . . . travels over pavement or cross country at speeds up to 23 m.p.h. . . . crosses tracks at will. Rig is self-loading . . . works alone or in fleets.

TOURNEAU
PEORIA, ILLINOIS

HIGH-SPEED UTILITY

TOURNAPULLS

KVS ENGINEERED *Completely*



No. 9 OF A SERIES

See OCTOBER "POWER" for description of DRY BOTTOM FURNACE

STEAM GENERATORS

with ALL COMPONENTS designed to meet specific operating conditions

1

SHADOW WALLS

KVS design provides for wide range or base load operation on all fuels. Desirable features include low first cost, low maintenance, and ability to maintain a high furnace temperature at low or high ratings resulting in high furnace efficiency.

2

PULVERIZER

Fine pulverization with the KVS Air-Swept Tube Mill assures rapid combustion resulting in high operating efficiency. Inasmuch as coal is ground in air, a carbureted fuel is prepared, enabling oxygen and carbon to combine for quicker true radiant combustion.

3

COAL BURNER

Combustion with the KVS Coal Burner results in high furnace temperature on all grades of coal handled. The Burner, of either the rotary or Vortex type, is low in first cost and maintenance and high in availability. High turbulence completes carburization of the coal.

4

TANGENT TUBE REAR FURNACE WALL

This feature in conjunction with shadow walls eliminates refractory maintenance between furnace and superheater pass. It permits higher furnace temperatures resulting in greater radiant heat transfer and increased furnace efficiency.

5

SUPERHEATER

Control of final superheat temperature is effected either by direct, separately fired, thermostatically controlled design providing high transfer rate by radiation or through the use of a convection superheater situated in the first gas pass and a thermostatically controlled bypass damper. Uniform steam temperatures are assured at all ratings.

6

STEAM PURIFIER

The KVS cyclone type steam drier and purifier produces steam in which the impurity carryover is less than .5 parts per million and the moisture content less than ¼ of 1% with 100% feed water make up. Recontamination of boiler water is eliminated by collecting solids and removing them from the boiler.

7

PREHEATER

KVS Air Preheaters assure high overall efficiency with low exit gas temperatures. They are of the downdraft gas and cross counterflow air type. Gas passes inside preheater tubes and air outside. Draft loss and pressure drop are minimized. Gases having high sulphur content can be safely handled.

8

DRY BOTTOM FURNACE

The KVS design Dry Bottom Furnace increases radiant heating surface and minimizes hopper maintenance. It provides the means of readily collecting and disposing of hopper ash.

KVS Steam Generating Equipment has been performance proved over the years. KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultation on your requirements.

Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

KVS ENGINEERING SERVICE

KENNEDY-VAN SAUN · QUALITY · Kennedy Products · NEW YORK USA · MFG. & ENG. CORP. · SERVICE ·

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MANUFACTURING AND ENGINEERING CORPORATION

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CANADA • ENGLAND • FRANCE • AUSTRALIA

FOR 10 BIG BENEFITS IN LOW-VOLTAGE

Specify

FLAMENOL

When you need a low-voltage cable that's easy to use and can take abuse, we suggest you get Flamenol, because Flamenol

Lasts Indefinitely Flamenol cable serves low-voltage circuits with a permanence that cuts maintenance costs, replacements, idle time for machines. Its chemically inert insulation remains unaffected by water, ozone, and the oils, acids, and alkalies normally met in service.

Saves Space small diameter makes wiring easier, neater; permits small conduit size.

Won't Spread a Fire Flamenol does not support combustion.

Easy to Pull Flamenol's smooth, tough surface makes pulling through conduit easier and quicker.

Strips Clean speeds soldering, splicing, terminating.

Simplifies Circuit Tracing a complete range of identifying colors speed hook-up and circuit tracing.

Light Weight Flamenol cable needs no extra protection except in the severest applications. It's light in weight, easy to handle.

Looks New, Stays New bright colors provide permanent identification, stay attractive over long periods of time.

Excellent Physical Properties has minimum tensile strength of 1500 pounds per square inch; minimum elongation of 100 per cent.

Superior Dielectric Strength Tests on No. 14 wire with 2/64-in. insulation show a breakdown strength of 720 volts per mil.

Flamenol is one of six modern cables mass produced and authorized for warehouse stock. Standard designs permit quicker delivery and a lower price than special types. Each cable offers special advantages in its recommended applications.

CORONOL*-GEOPRENE

For high-voltage power distribution. The only rubber-type cable guaranteed for 80-C copper temperature. GEA-1788, GEA-4848.

VERSATOL*-GEOPRENE

For low-voltage distribution and branch circuit wiring to motors and controls. Resists wear, moisture and heat aging. GEA-4848.

INTERLOCKED-ARMOR

For overhead power distribution throughout the plant. Needs no conduit, speeds installation. Bulletin GEA-4507.

VARNISHED-CAMBRIC LEADED

For high-voltage feeders, distribution in underground ducts. Ideal for heavy loads in wet locations. GEA-2623.

GEOPRENE PORTABLE

For power to portable shovels, pumps, construction machinery where resistance to rough handling and excessive flexing is needed. GEA-4229.

**Trademark Reg. U. S. Patent Office.*

CABLE

KENNETH MAY, ***Chief Maintenance Engr., Lycoming Division of Arco Manufacturing Corp., says,***

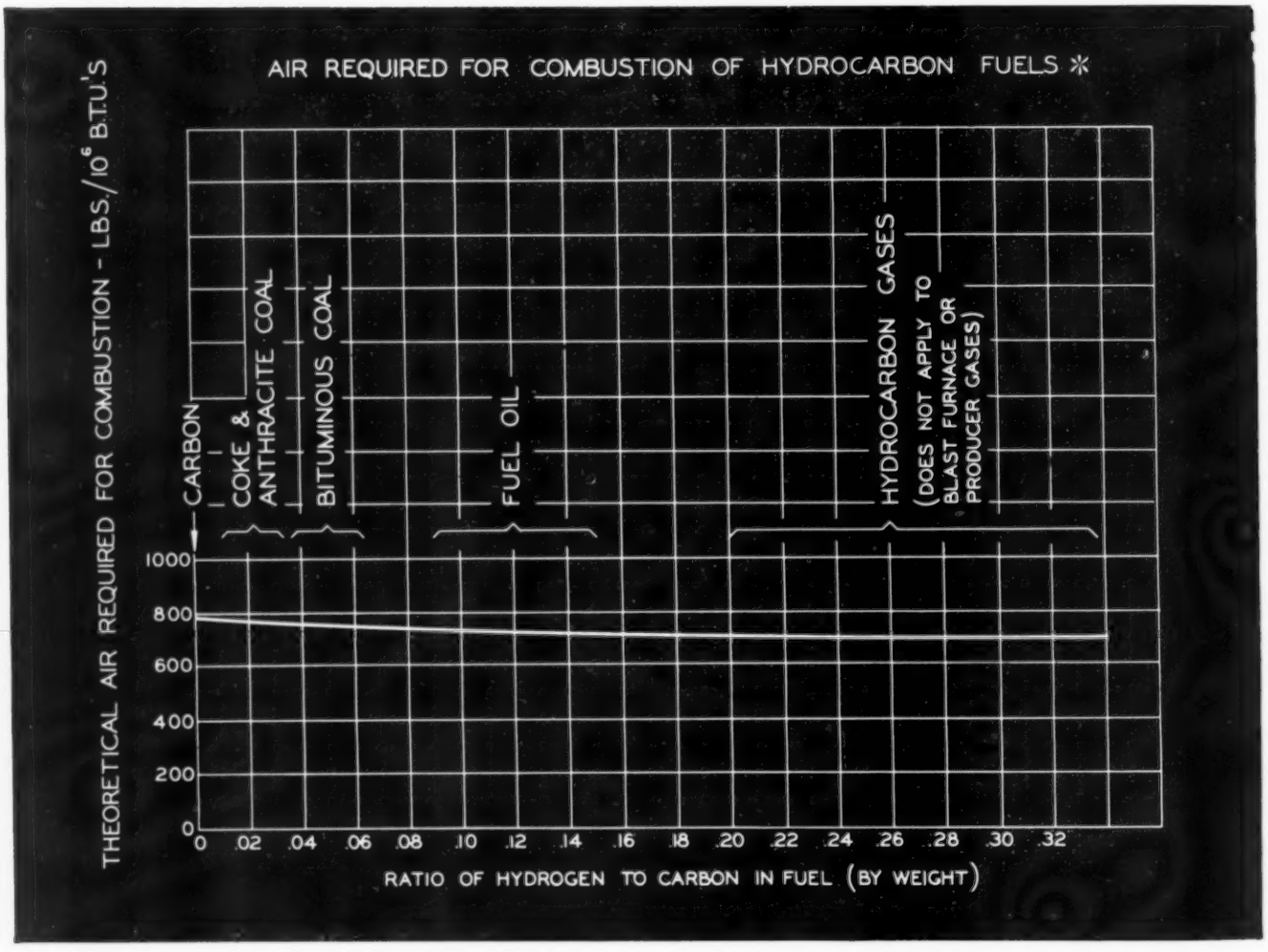
"Flamenol cable has saved us a lot of maintenance expense. We used to have trouble with oil going right through the insulation on our bus-drop cable, but since we installed Flamenol in '42, not one of those 900 cables has given us a maintenance problem."

Flamenol cable is made in a wide range of constructions which will fit almost every wiring application at voltages up to 600. It is described generally in Bulletin GEA-4352; Control cable is described in GEA-4634; Mine-telephone cable in GEA-3612. For copies, call your nearest G-E representative, or write Apparatus Department, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC

502-85

for *all types* of multi-fuel


AIR REQUIRED FOR COMBUSTION OF HYDROCARBON FUELS *
THEORETICAL AIR REQUIRED FOR COMBUSTION - LBS./10⁶ B.T.U.'S
CARBON
COKE & ANTHRACITE COAL
BITUMINOUS COAL
FUEL OIL
HYDROCARBON GASES
(DOES NOT APPLY TO BLAST FURNACE OR PRODUCER GASES)
1000
800
600
400
200
0
0 .02 .04 .06 .08 .10 .12 .14 .16 .18 .20 .22 .24 .26 .28 .30 .32
RATIO OF HYDROGEN TO CARBON IN FUEL (BY WEIGHT)

* RELATION BETWEEN HEAT VALUE OF FUEL AND AIR REQUIREMENTS

Note how closely a measurement of heat released within a boiler furnace indicates the amount of air required for combustion, not only for any single fuel but even for fuels of widely differing physical characteristics.

installations!

the Hagan differential master system of automatic combustion control

In many situations, fuel economy demands that boilers be able to use two, three or even more fuels, either singly or in varying combinations.

One typical oil refinery, for example, burns refinery gas, oil, and mercaptan gas, sometimes singly, sometimes two, or all three at the same time.

B.t.u. content of the oil is relatively uniform; refinery gas varies both in B.t.u. content and density.

Yet—by the Hagan Differential Master method of automatic combustion control, excess air is correctly controlled in spite of all fuel changes.

B.t.u. input is automatically adjusted to load demand by the Hagan Steam Header Master Sender. The Hagan Differential Master Sender utilizes the boiler itself as a calorimeter of heat input to control air flow. In this installation, the heat input of all fuels in use at any instant is automatically totalized by the boiler itself, and the air flow is controlled accordingly. Control is positive and direct; there is no lagging corrector system.

Automatic control by other methods requires extensive and complicated apparatus, and is commercially impracticable because of cost and operating difficulties.

The Hagan Differential Master method has been thoroughly tested in service. It has been applied to boilers burning oil, gas, pulverized coal, and a variety of multiple fuels. Boiler sizes range from 30,000 lbs./hr. at 200 p.s.i. to 650,000 lbs./hr. at 1,800 p.s.i. Every installation has been entirely satisfactory.

Our engineers will be glad to give you full information. Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

HAGAN CORPORATION

HAGAN
HALL
BUROMIN
CALGON

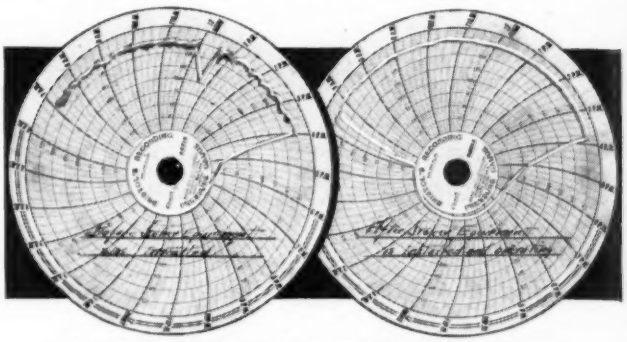
BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

40% COAL SAVING

Flexible Pneumatic Spreader Stoker Burns Coal and Wood-Waste Combination

IN the boiler room of the American Furniture Company, Martinsville, Virginia, an Iron Fireman Pneumatic Spreader stoker, producing high combustion-chamber temperatures with *auxiliary* coal fuel, is enabling the company to get most of its needed power from its own waste shavings and sawdust. Coal consumption is sharply reduced, being used only to generate the high temperatures needed to fire the wood waste. Mr. R. M. Simmons, President of the American Furniture Co., says: "Practically all of the material fed into the furnaces is consumed in suspension." This complete combustion reduces the smoke nuisance, and gets money-saving heat value even out of the wood particles which formerly escaped, unburned, up the stack. Since the installation of the Iron Fireman Pneumatic Spreader stoker, boiler room labor is very light.

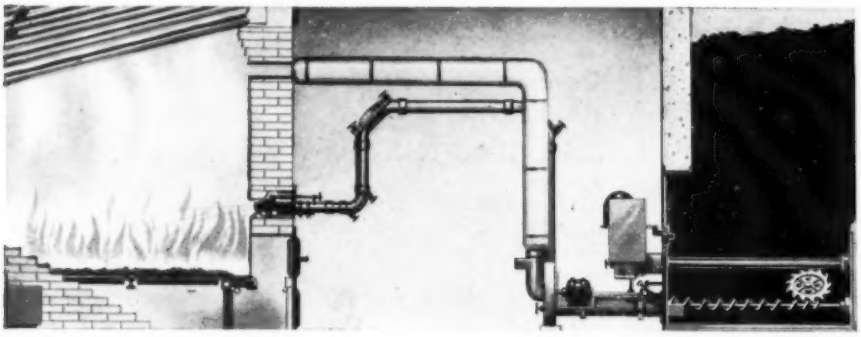
Steam pressure, so important in the correct seasoning of furniture woods, is remarkably uniform with Iron Fireman stoker firing. The recording chart shows a steady 175 pounds pressure. Compare the "before" and "after" pressure charts shown above.



Hand Firing and Iron Fireman Firing in Same Boiler

Left hand chart shows continuous variations of 25 pounds pressure and represents performance of furnace under hand-firing. Right hand chart gives clear picture of the even pressure maintained by the Iron Fireman Pneumatic Spreader stoker in this same boiler.

Installation is Flexible. To profit from the unique advantages of Iron Fireman Pneumatic Spreader stoking, you don't have to re-build your whole steam plant. This pneumatic stoker is EASY to install, whatever the boiler-room set-up may be. It is more than just adaptable —it is *flexible*. Operating through overhead pipes which leave the floor space clear, Iron Fireman's self-contained pneumatic coal-conveying system is easily "elbowed" into any boiler plant. Stoking mechanism can be located in front of the boiler, at the side, or even behind the boiler! It may even be located in another room, or on a different floor level. (This separation of stoking mechanism from direct furnace heat cuts maintenance costs and gives longer life to moving parts.)



IRON FIREMAN PNEUMATIC SPREADER STOKER. Steam size coal is metered from hopper or main coal bunker and transferred by pneumatic conveyor to furnace. Conveyor nozzle accurately spreads larger particles of coal over entire grate in a shallow, uniform fuel bed. Preheated fines burn in suspension, reducing cinder carry-over and greatly improving combustion efficiency and responsiveness, as compared with stokers which do not preheat coal.

COAL STOKERS AND OIL BURNERS FOR INDUSTRIAL FIRING

IRON THE IRON FIREMAN

with Iron Fireman Stoker

Plant of the American Furniture Company, Martinsville, Virginia.

Boiler room of the American Furniture Co. Pipes inserted in boiler fronts are pneumatic coal conveyors. Wood refuse enters combustion chamber through three chutes shown at upper left.

Operation is Flexible. Thanks to Iron Fireman's exclusive Air Volumeter, which *maintains* correct fuel-air ratio *constantly* for maximum combustion efficiency, the Pneumatic Spreader stoker is highly responsive to fluctuating load demands. This sensitive combustion control permits the efficient burning of small size, low ash-fusion coals. Even sub-bituminous and lignite may be burned very efficiently. This adaptability of the Iron Fireman Pneumatic Spreader stoker to lower cost coals means greatly reduced operating expense. Similarly, this stoker is readily adapted to handle combination firing in which coal is used as a "booster" to permit the firing of local industrial waste-products. This means a further reduction in fuel costs.

Five-Fold Advantage of Pneumatic Spreader Firing

Conveyor fan in the stoker unit performs five important functions:

1. Conveys steam-size coal from pick-up chamber (to which it has been carried from hopper or bunker by conveyor worm) into combustion chamber of furnace.
2. Pre-heats coal for quick ignition. Coal-conveying medium is high temperature combustion gases from upper part of combustion chamber, mixed with air, and drawn through insulated pipe; then forced at high speed through coal pick-up section. This heating dries the coal, and raises its temperature almost to the flash point on its way to the furnace.
3. Spreads coal evenly over new-type grate by means of adjustable nozzle.
4. Provides pre-heated overfire air necessary for efficient firing.
5. Meets at right angles the flow of undergrate air coming up through fuel bed, producing maximum turbulence needed for complete combustion.

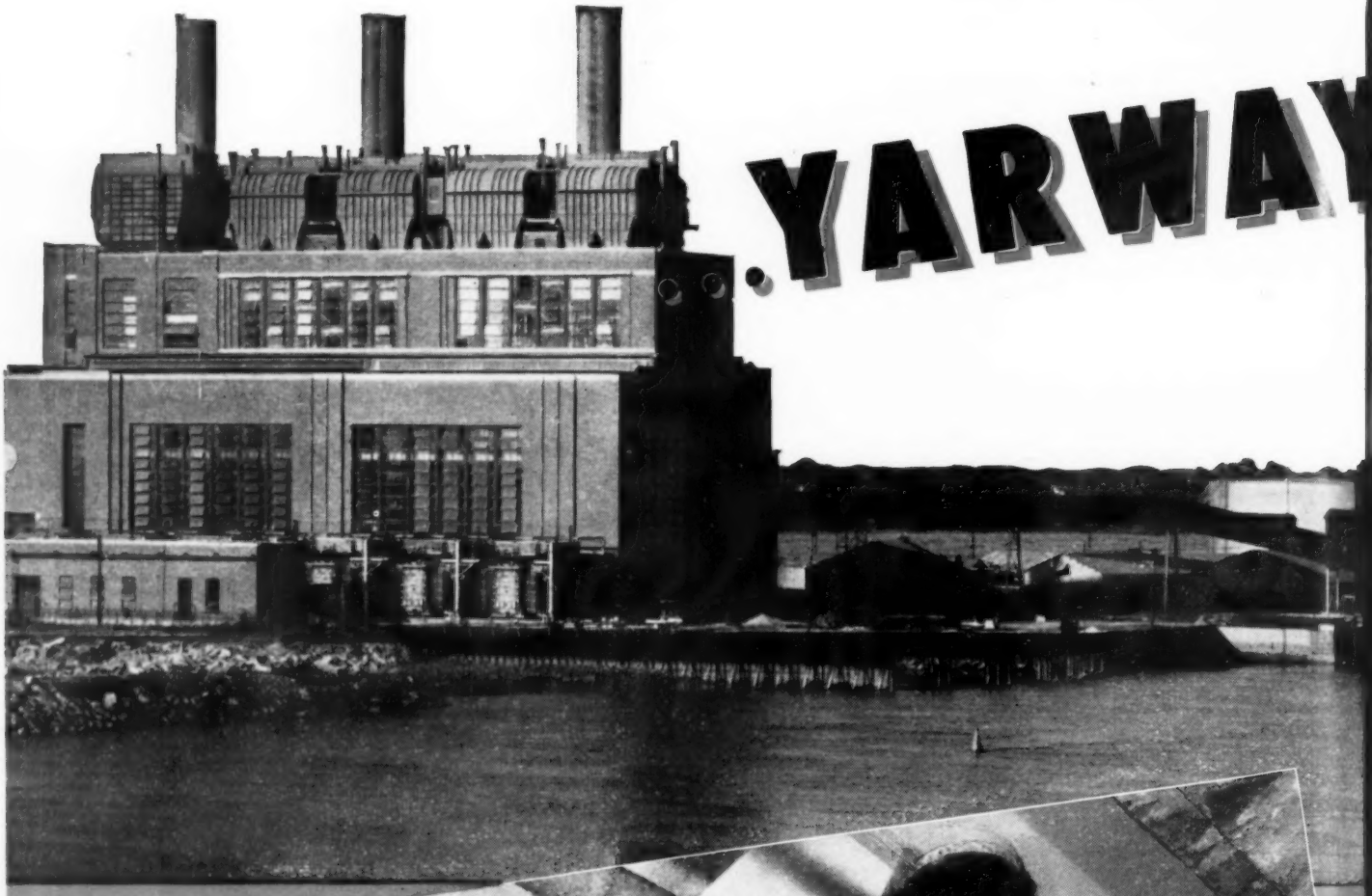
Don't GUESS about Your Steam Costs

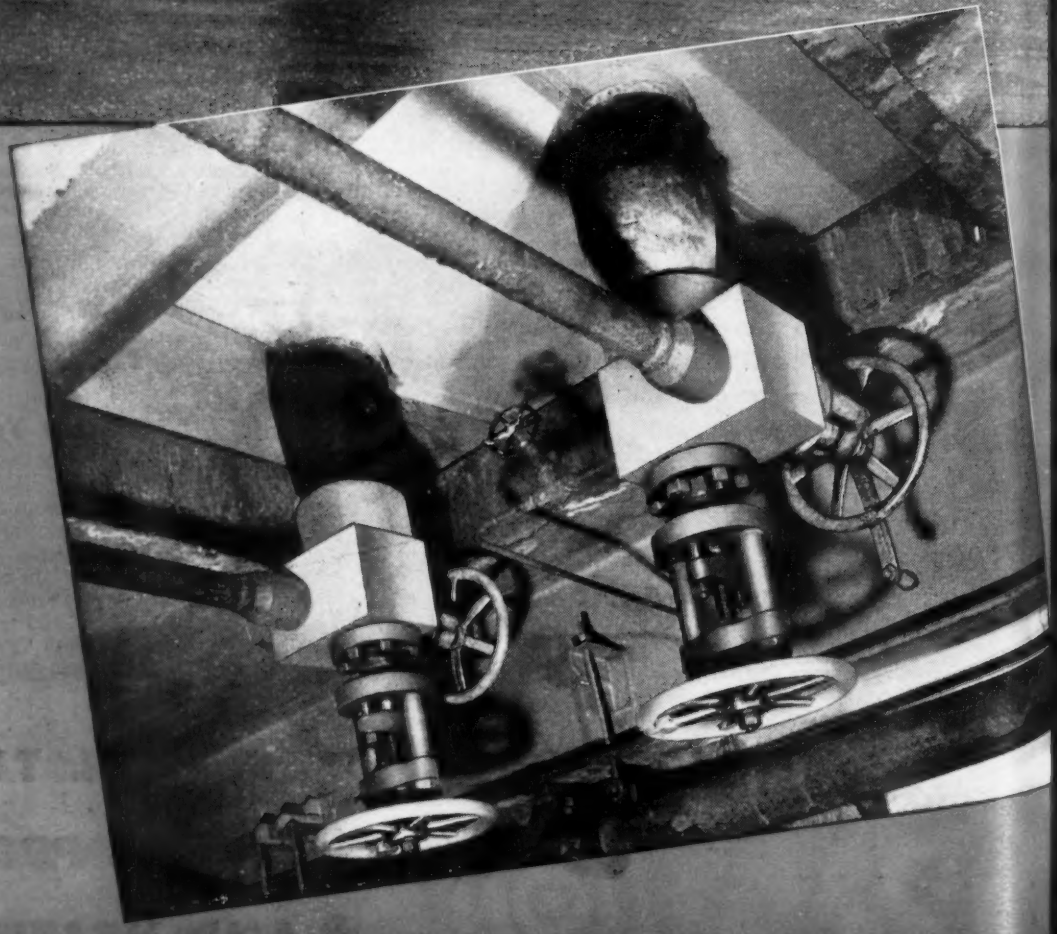
Find out *exactly* what YOURS are. Request Iron Fireman's engineering survey and get an expert analysis of your present steam plant operation, without cost or obligation to you. Iron Fireman technical men have made thousands of these surveys to determine in advance what savings could be effected with Iron Fireman equipment. Their quarter-century of experience with every size and type of firing job is at your disposal. For this expert boiler-room survey, address: Iron Fireman Manufacturing Company, 3106 West 106th Street, Cleveland 11, Ohio. Other plants in Portland, Oregon; Toronto, Canada.

FIREMAN

FOR ALL TYPES OF POWER, PROCESSING AND HEATING JOBS

Public Service (N.J.) Chooses YARWAY





Burlington, N. J., Station of the Public Service Electric and Gas Company. Four boilers at this plant, and two at Public Service's Marion Station are each equipped with two Terway Unit Tandems. Steam pressure boiler 1350 psi, turbine 1250 psi. Temperature 950° F. Output, each boiler, 550,000 lbs per hour; high pressure turbines, 125,000 KW each.

YARWAY BLOW-OFF VALVES

UNIT TANDEMS

FOR HIGH PRESSURE BLOW-DOWN SERVICE

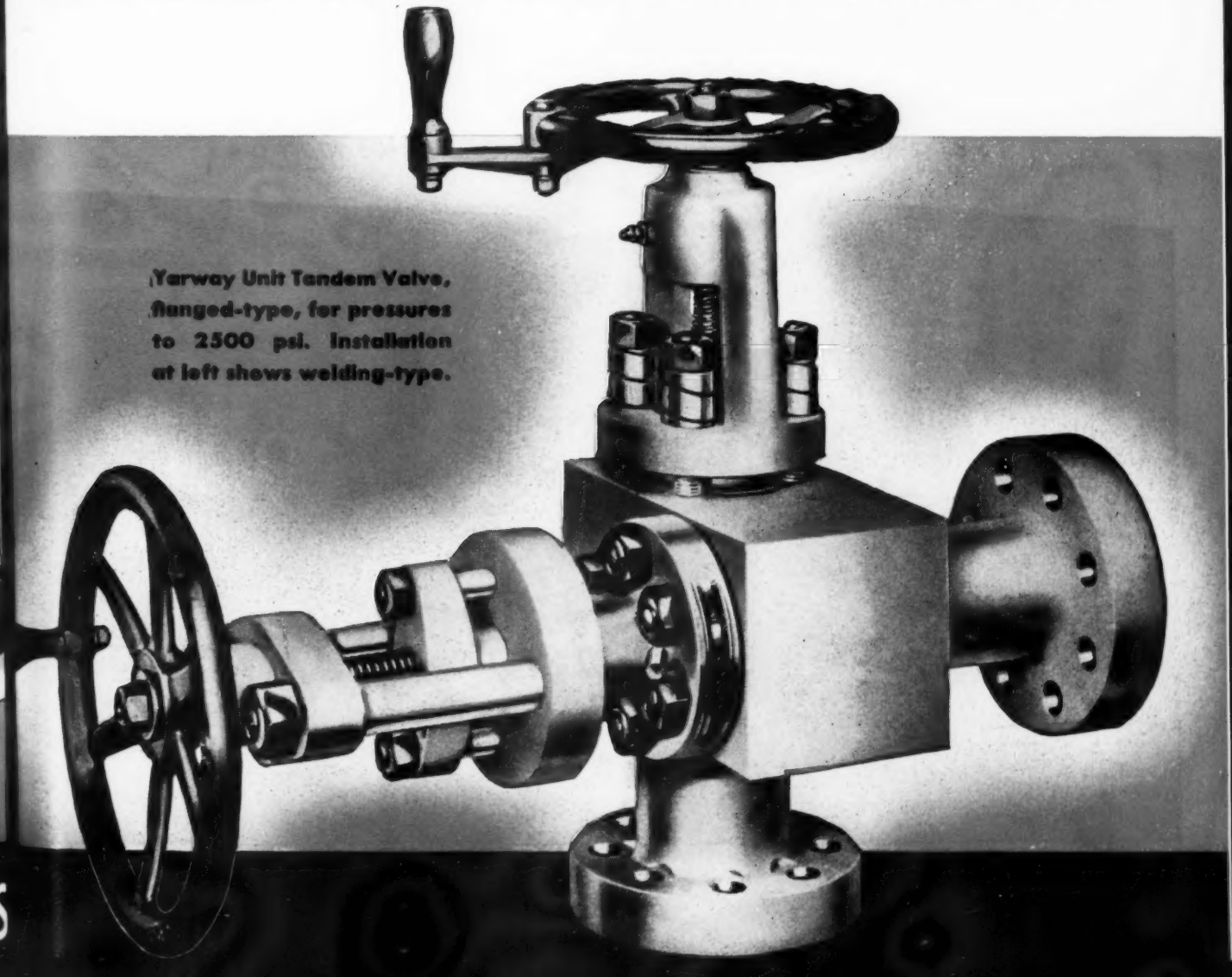
Why has the Public Service Electric and Gas Company of New Jersey, like so many other leading utilities, selected Yarway Unit Tandem Blow-Off Valves for their high pressure boilers? The answer is simple—*proved performance.*

Yarway Unit Tandems have proved themselves unequalled in service throughout all industries on pressures from 400 to 2500 psi. This tandem is a combination of the Yarway Hard-Seat* Valve (next to boiler for blowing) and the famous Yarway Seatless Valve (for sealing)—both contained in a one-piece forged steel body. This rugged construction eliminates the interconnecting flanges, bolts and gaskets required in bolted tandem designs, making a trim, compact unit.

Nearly 40 years of laboratory and field experience concentrated on blow-off valve requirements, makes Yarway a logical source of supply for your next blow-off valves. Write for Catalog B-432 for pressures up to 2500 psi . . . Catalog B-424 for lower pressures.

** Seats furnished either separate or integral.*

YARNALL-WARING COMPANY • 100 Mermaid Avenue, Philadelphia 18, Pa.



Yarway Unit Tandem Valve, flanged-type, for pressures to 2500 psi. Installation at left shows welding-type.

Meeting your steam requirements with CONTROLLED SUPERHEAT over WIDE LOAD RANGES

A METHOD of superheat control which successfully overcomes the disadvantages of methods such as damper by-pass, "desuperheating" by spraying water into steam, and others, has been developed and applied to Foster Wheeler steam generators.

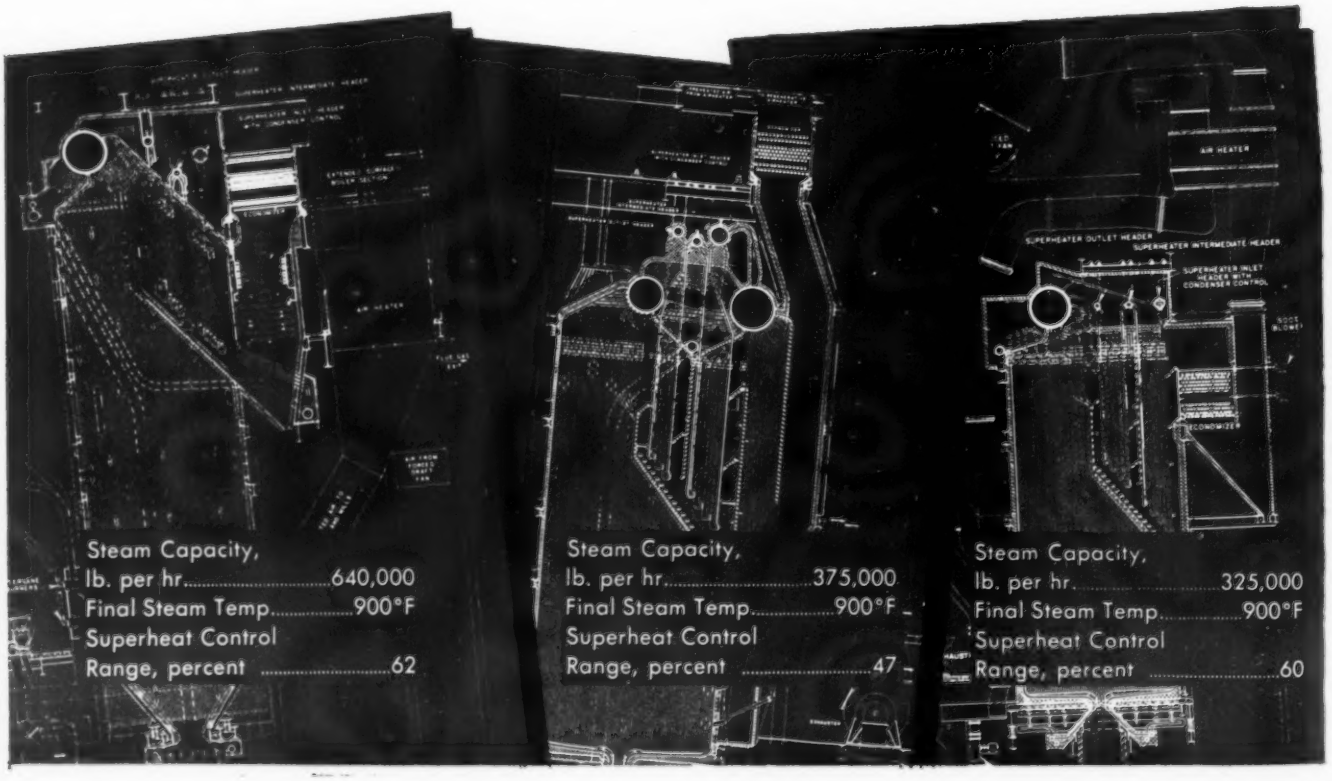
The Foster Wheeler method operates by reducing the latent heat of the steam in the superheater inlet header. It differs from conventional desuperheating because no water is added to superheated steam. Simply, superheating becomes a controlled operation from inlet to outlet.

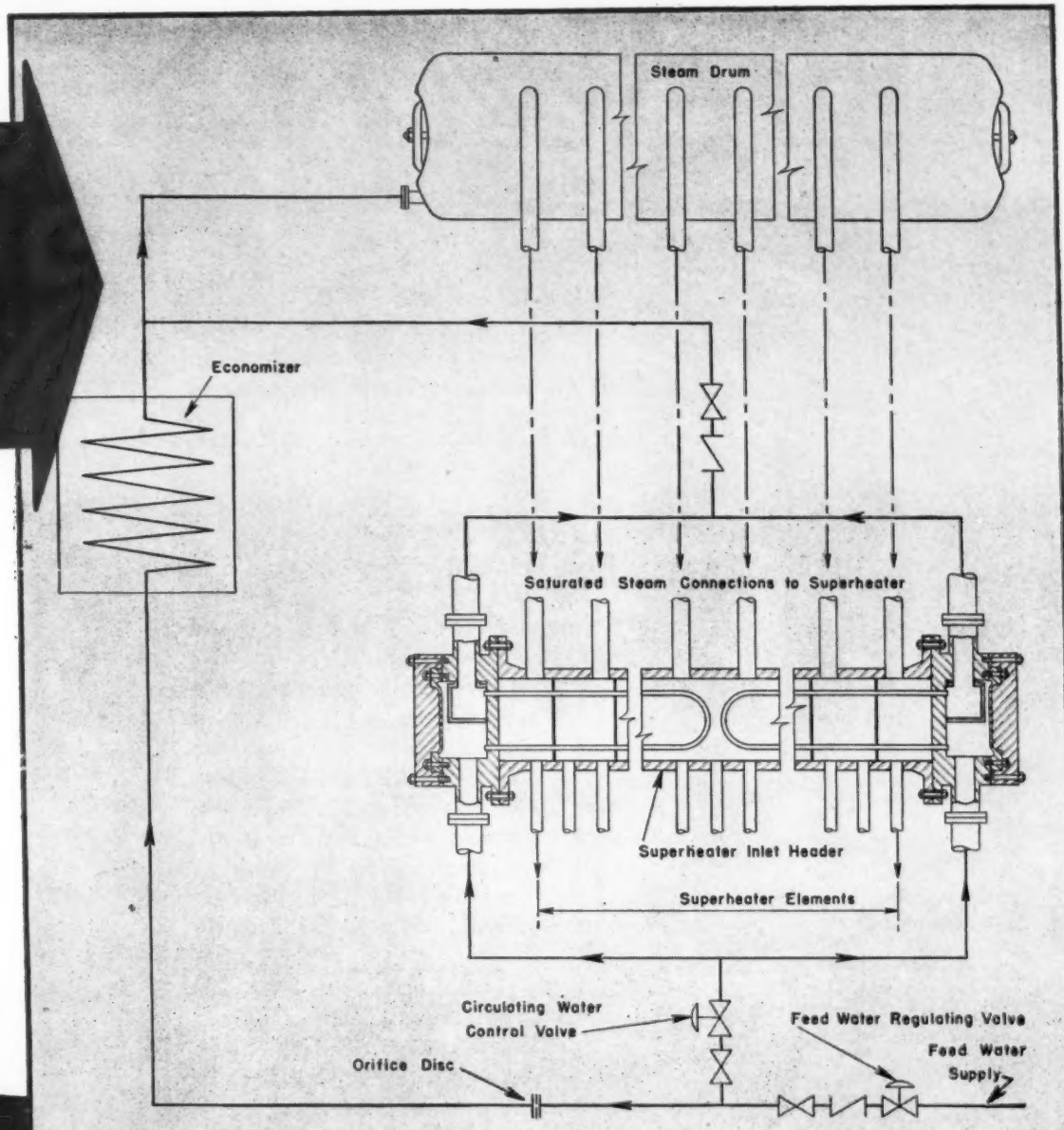
Boiler feedwater is diverted around the economizer and passed through tube bundles located in the superheater inlet header. This relatively cool feedwater condenses some of the entering cleaned and dried steam. The amount of moisture entering the superheater is regulated to provide positive and accurate control of final temperature. In addition to the wide range control possible when this device is used, superheated steam is not contaminated by water, and excessive metal stresses are avoided.

A reprint of an article describing in detail a specific application of Foster Wheeler condenser-type superheat control is available. Ask for B-46-20.

FOSTER WHEELER CORPORATION

165 BROADWAY, NEW YORK 6, NEW YORK

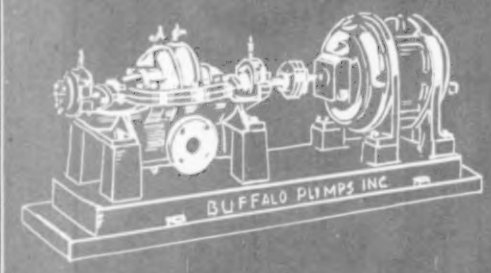


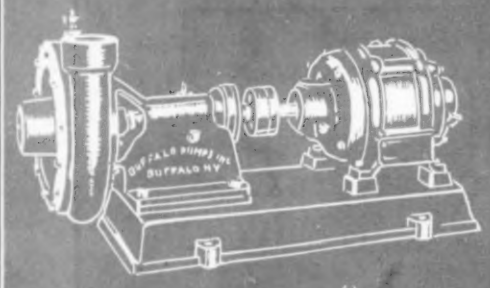


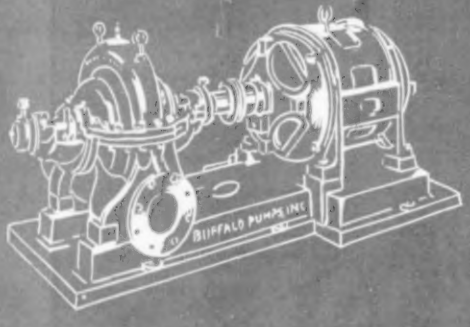
This enlarged section through the superheater inlet header shows the arrangement of condenser-type control of final steam temperature.

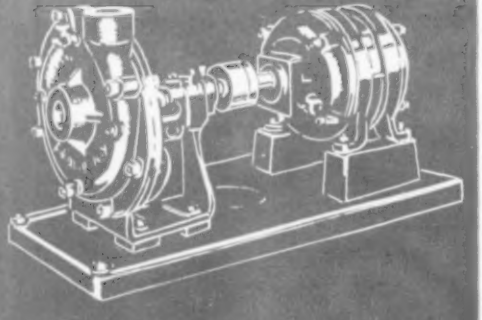
Steam Capacity, lb. per hr. 310,000
Final Steam Temp. 1000°F
Superheat Control Range, percent 58
Steam Capacity, lb. per hr. 250,000
Final Steam Temp. 825°F
Superheat Control Range, percent 60

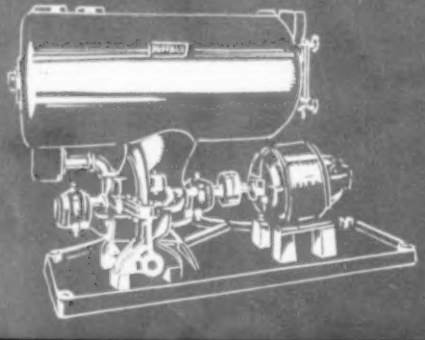
EACH *Excels* IN ITS JOB!











BUFFALO CLASS "RR" Single Suction Multistage Pumps give you ideal performance in *clear water* at high pressures, any temperature, all types of drives. Sizes for many heads and gpm capacities. Write for Bulletin 980-B.

BUFFALO DOUBLE BALL BEARING Single Suction Pumps, Types "CS" and "CL" are proven performers on *hard service jobs of constant operation.* Special alloys available for special liquids. Write for Bulletin 976-B.

BUFFALO DOUBLE SUCTION Single Stage Centrifugal Pumps are recommended where the *finest obtainable construction is desired.* Direct or pulley drive, turbine or motor driven. Write for Bulletin 955-L.

BUFFALO CLASS "CH" Centrifugal Pumps give you *far lower priced units* with no sacrifice in workmanship and materials. *For heads* up to *120'.* All standard jigs are used, all parts interchangeable. Write for Bulletin 965-E.

BUFFALO AUTOMATIC Condensate Pumps and Receivers will *handle condensate at 212° without such prevalent troubles as vaporization, air binding, reduction in capacity and pressure.* Write for Bulletin 960-B.

BUFFALO PUMPS, INC.

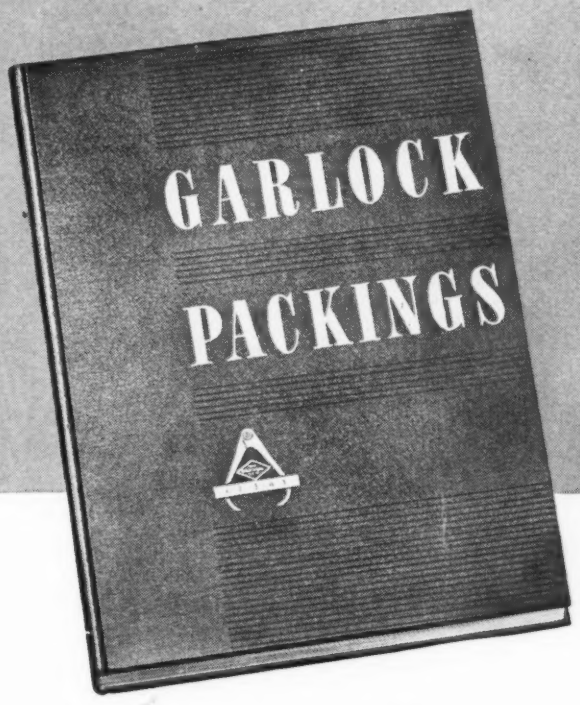
488 Broadway **Buffalo, N. Y.**

Canada Pumps Ltd., Kitchener, Ont.

for handling clear water at high pressures, any temperature
"Buffalo"
Class "RR" Single Suction Multistage Pumps
BUFFALO PUMPS, INC.
"Buffalo"
Double Ball Bearing Single Suction PUMPS
"Buffalo" Double Suction Single Stage Centrifugal PUMPS
Centrifugal Pumps
Automatic Condensate Pumps and Receivers

"Buffalo" **PUMPS**

FOR EVERY NEED



NEW GARLOCK CATALOG

Helps you select The Right Packing

IF YOU BUY or use packings or gaskets you need this new Garlock catalog.

Its 224 pages describe and illustrate packings for high pressures and low pressures—for water, air, steam, acids, solvents, oils and other liquids and gases. So whether you need a packing made of rubber, synthetic rubber, asbestos, cotton, flax, rayon, leather, plastics or metals, this catalog will help you select a Garlock product suitable for your job—a product manufactured in the Garlock factories and measuring up to the highest quality standards which Garlock has rigidly maintained for sixty years.

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Fig. 2228
200 lb. Bronze
Union Bonnet Gate

Fig. 1640
"King Clip" Gate

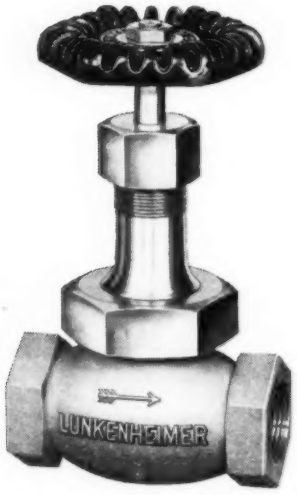
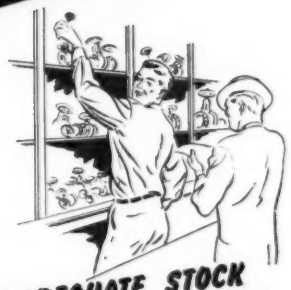


Fig. 16
Bronze Globe



AN ADEQUATE STOCK
..... close at hand

A big stock is not enough. Lunkenheimer Distributor stocks are carefully geared to the particular needs of each territory. This "planning ahead." plus your Distributor's aid in solving operating and maintenance problems, rapid delivery service . . . are the reasons why so many plants rely on their Lunkenheimer Distributors for complete valve service.

...YOU'RE SURE OF HIGH QUALITY LOW-COST VALVE SERVICE

● With Lunkenheimer Valves in the line . . . you get better valve service . . . every time. That's the considered opinion of engineers and operating men throughout the nation. From long experience, they know that Lunkenheimer Valves give **extra** years of **better** service . . . set new low records for over-all valve cost.

● Lunkenheimer leadership in engineering and design, valve metallurgy and craftsmanship has been established over many years . . . protected by rigidly enforced standards of highest quality . . . recognized by valve users in practically every industry. When buying valves, the Lunkenheimer name is your assurance of full service . . . complete satisfaction.

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"QUALITY"

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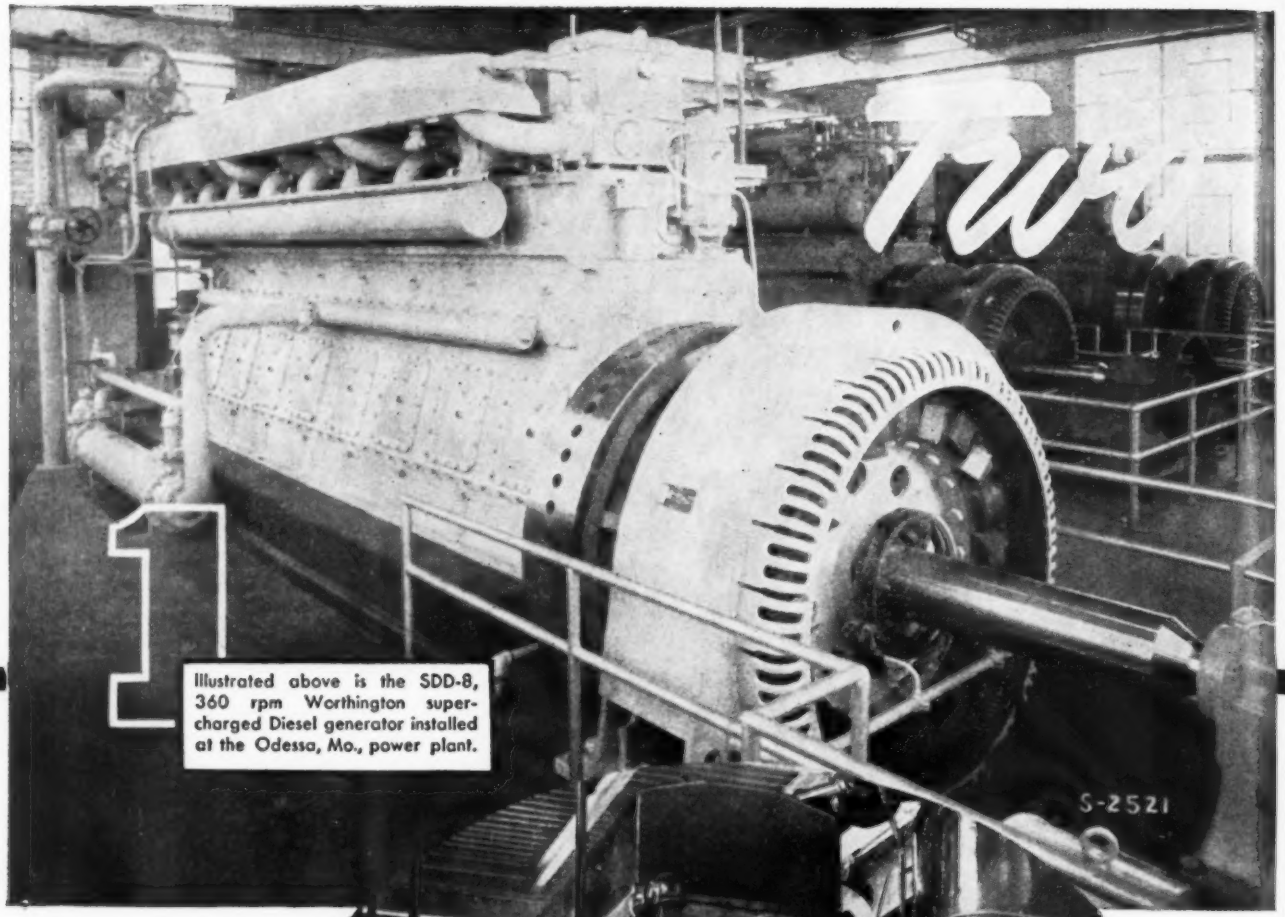
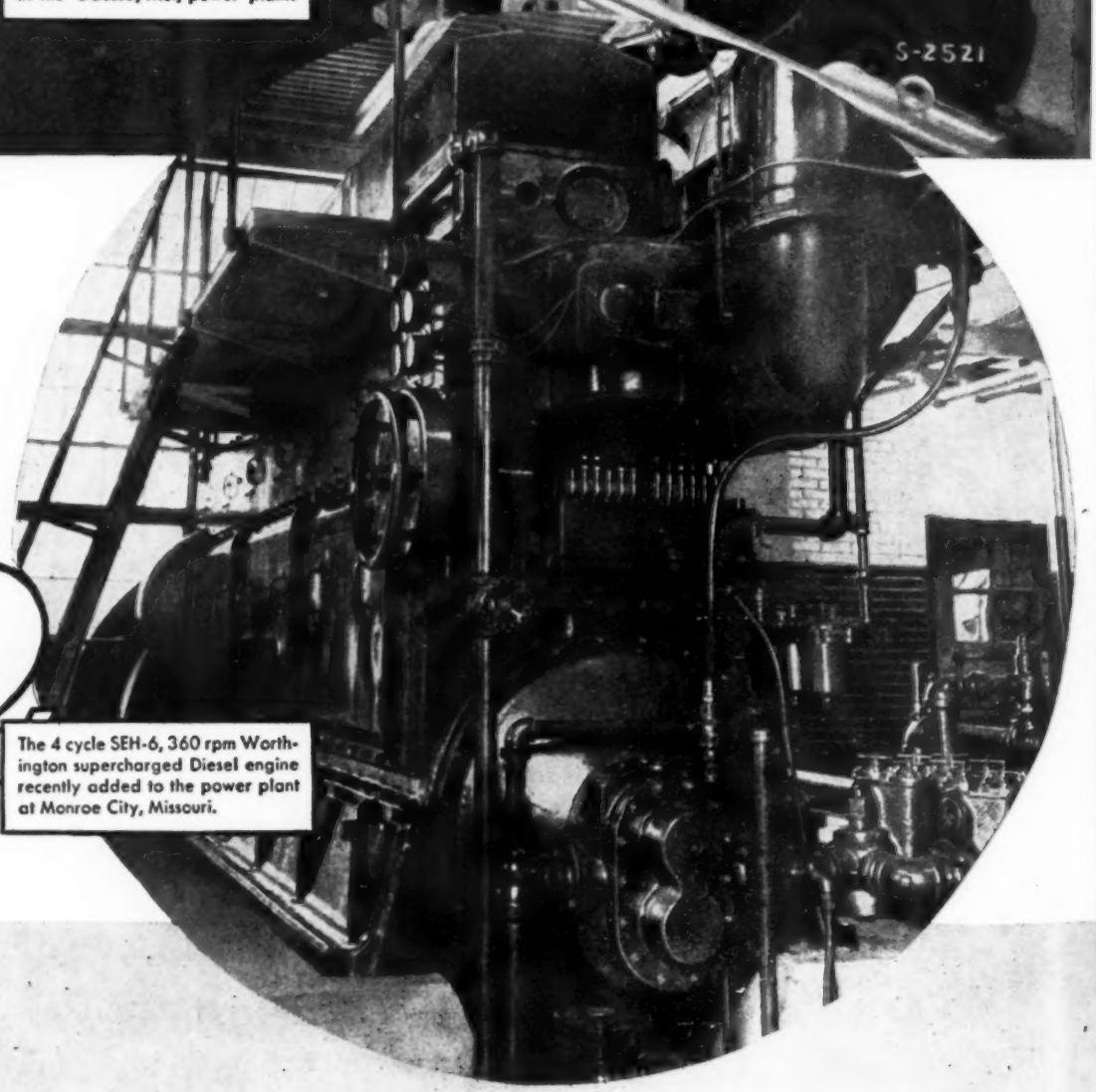


1

Illustrated above is the SDD-8, 360 rpm Worthington supercharged Diesel generator installed at the Odessa, Mo., power plant.



2

The 4 cycle SEH-6, 360 rpm Worthington supercharged Diesel engine recently added to the power plant at Monroe City, Missouri.

Power Plants

PREPARED FOR TOMORROW'S GROWTH

Operating with Economy Today

In Missouri the municipalities of Monroe City and Odessa design their generating plants for *future* power demands by installing Worthington supercharged Diesel engines, today.

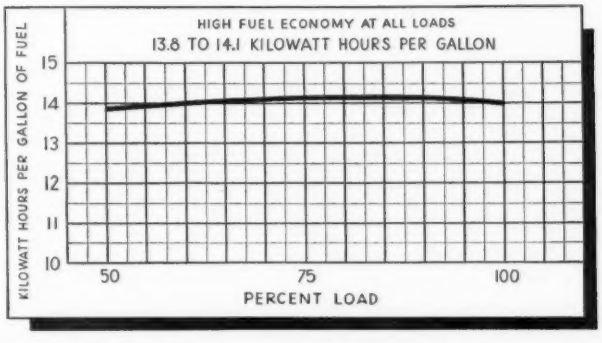
And the new Diesels . . . installed in both plants in 1946 . . . supplement other Worthington Diesels placed in Monroe City since 1935, and in Odessa since 1939.

For the investigated facts proved to these two communities that the low fuel demands of the Worthington supercharged Diesels were economically sound, even when operated at fractional capacity.

Yet, future increases in power demands are adequately provided for at the same low fuel consumptions (see chart), making the future use of these Worthington Diesels continually profitable.

So if your community seeks power that is highly economical today . . . greatly profitable in the future . . . designed for long life and easy maintenance . . . then investigate Worthington supercharged Diesel engines.

Write for more information and prove to yourself that *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.*



This chart illustrates the Worthington Diesel's low fuel costs . . . and the very slight rise in fuel demands when changed from fractional to full power loads.

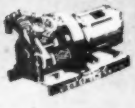
WORTHINGTON

E7-8

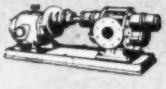
YOUR PARTNER IN POWER PROGRESS

Diesel engines, 150 to 2,640 hp . . . gas engines, 175 to 2,470 hp . . . dual fuel engines, 225 to 2,470 hp.

WORTHINGTON-BUILT AUXILIARIES



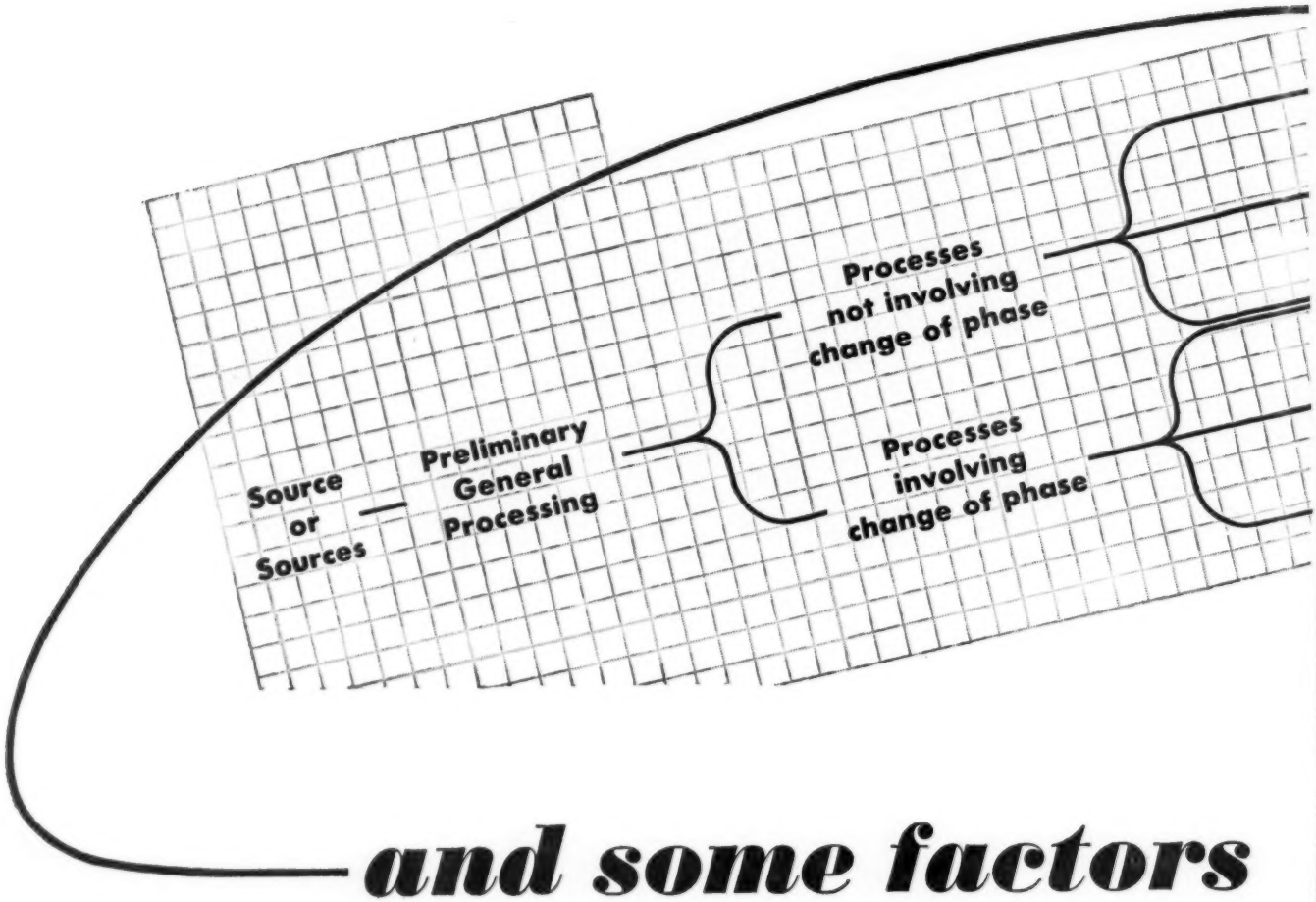
Air King Compressors



Oil Transfer Pumps

Cooling Water Circulating Pumps

Evaporative Type Engine Water Cooler


Source or Sources
Preliminary General Processing
Processes not involving change of phase
Processes involving change of phase

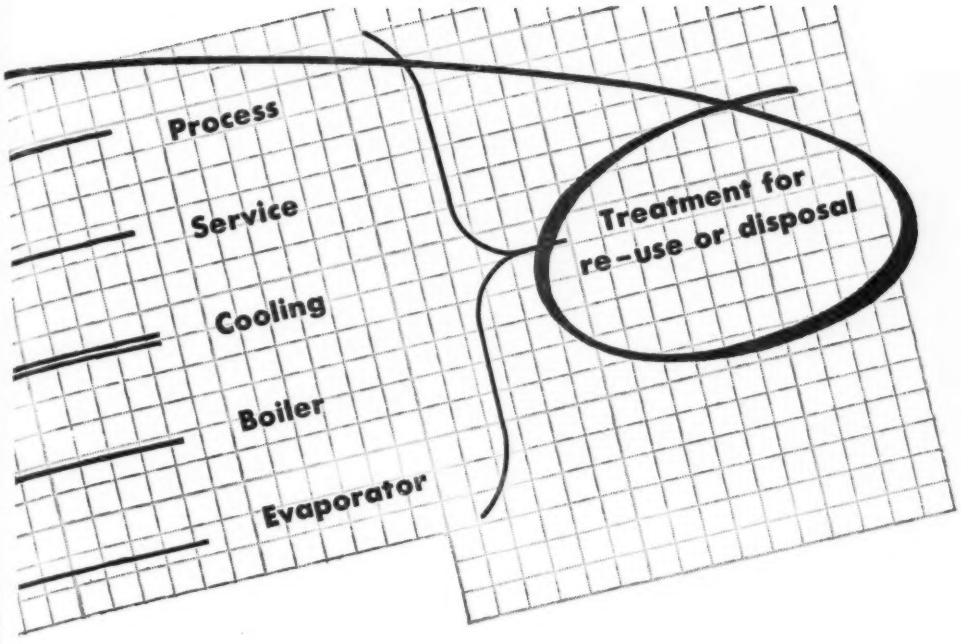
and some factors

Few industrial plants today find any problem in the disposal of water which has been converted into steam. Condensate is distilled water, and it is hot. On both counts it is more desirable than the original raw water for use in steam generation.

Waters which have been used in plant processes, however, present a major problem in many industrial plants. This problem can no longer be solved by simply discharging these waters as waste into the nearest stream. This may still be the most convenient solution, but there are other factors which must now be taken into account. Among the most important of these factors are:

1. Growing public opposition to the pollution of streams and other water sources, coupled with an increasing sense of responsibility on the part of industry.
2. Sharp decrease in water reserves, due to five years of sub-normal rainfall followed by years of abnormally high water consumption resulting from increased industrial activity. More and more, industry is learning to look at water as an engineering material which must be conserved.
3. Increasing cost of treatment of water for industrial uses because of contamination of sources by industrial wastes.
4. Realization by industry that re-use of water, and recovery of valuable constituents will, in many cases, be a profit-producing procedure.

The mere listing of these four factors suggests the complexity of the problem. To answer the single question of whether to re-use water or



which affect it——

dispose of it as waste involves knowledge of legal requirements and restrictions; consideration of the nature and extent of available water sources and of the cost of water; study of the water requirements of the various plant processes; analysis of the water in relation to plant requirements and to the value of the materials which might be recovered from it, and many other factors.

To determine the most economic procedure, every plant operation involving the use of water must be taken into consideration.

All of these matters are within the scope of Hall service. Hall representatives are prepared to make a thorough study of your plant and to recommend procedures which, giving due weight to all factors, represent the most efficient and economic solution *to your specific problems.* Correspondence concerning any phase of industrial water conditioning is invited.

Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pennsylvania.

HALL LABORATORIES, INC.

(A Subsidiary of Hagan Corporation)

HAGAN
HALL
BUROMIN
CALGON

CONSULTANTS ON
INDUSTRIAL WATER TREATMENT
HALL SYSTEM OF BOILER WATER CONDITIONING
INDUSTRIAL WASTE RECOVERY AND DISPOSAL

Remember this Fan . . .

You don't have to baby the new Moore fans and blowers. Rugged and corrosion-resistant, you can install them and forget them. Read why!

The Moore Company of Kansas City, Mo., realized that pressure fan users were getting fed up with breakdowns and time-consuming servicing of their air-moving equipment.

So, this company decided to design a blower . . . from start to finish . . . that would give extra-long life and trouble-free performance.

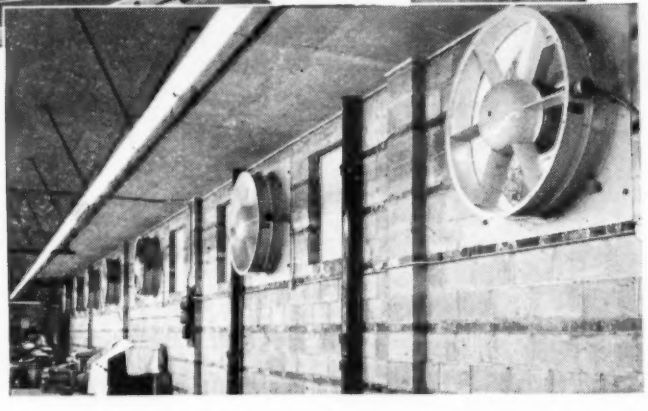
In the hub of their new unit, they built a heavy-duty, direct-drive motor. This has only one moving part . . . the rotor to which the fan is attached.

The entire motor assembly is isolated by soft synthetic rubber mounts. Bearings are permanently lubricated and sealed.

But, that's not all. Moore engineers also realized that corrosion figured heavily in fan failures. Blades, guide vanes, hubs, and rims must withstand damp or steamy atmospheres, smoke, coal dust . . . or even acid fumes.

The one metal Moore found to lick all these conditions was the INCO *Nickel Alloy . . . MONEL*.*

In addition to its corrosion resistance, Monel also fights abrasion. And, it's as strong as structural steel. Thus, the curved and formed fan sections are thinner and far lighter than cast parts . . . without sacrificing strength.



Moore direct-drive ventilating fans and pressure blowers are available from 36" to 96" in diameter, with capacities up to 125,000 cu. ft. per minute. Other Moore fans range up to 24 ft. in diameter, capacities of more than 1,000,000 C.F.M. Made of tough, corrosion-resistant Monel, they are used today by power stations, foundries, oil refineries, textile mills, and many other industrial plants. For detailed information, address The Moore Company, 544 Westport Road, Kansas City 2, Missouri.

* * * *

The above is another example of how strong, long-lasting INCO Nickel Alloys are serving modern power plants. Other applications include preheater tubing, valves, pump parts, fittings, and gaskets.

If *you* are looking for one metal to solve a tough combination of problems, find out more about the family of INCO Nickel Alloys. Full technical information and assistance are yours for the asking.

*Reg. U. S. Pat. Off.

The International Nickel Company, Inc.

67 WALL STREET **NEW YORK 5, N. Y.**

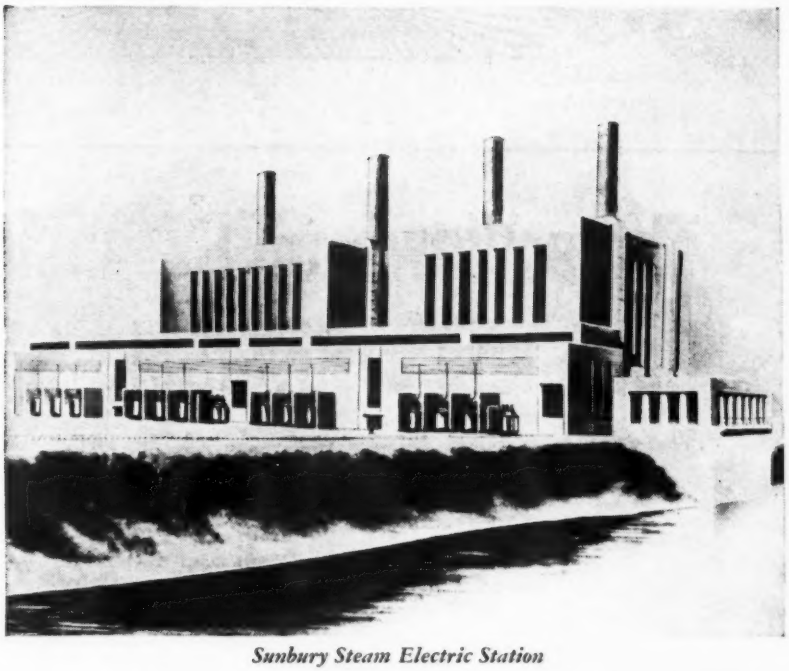
EMBLEM OF SERVICE
INCO
TRADE MARK

NEWS

FROM THE POWER FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON

Boiler Feed at Sunbury



Sunbury Steam Electric Station

Anticipating future demands for electric power in Central Eastern Pennsylvania, Pennsylvania Power & Light Company, in 1945, authorized the construction of a large central steam electric generating station to be located at Shamokin Dam, near Sunbury, Pa. While the plant area and water supply are sufficient for an ultimate capacity of 550,000 kw, the first two units to be installed are of 75,000 kw.

Because of their wealth of experience in high pressure steam electric stations, Worthington engineers were asked to cooperate with the power company's engineers on the problems relating to boiler feed service.

After careful analysis of the requirements for this plant, Worthington has been awarded a contract for 6 multi-stage centrifugal, barrel-type boiler feed pumps, each of which has a capacity of 855 gpm of 269 F water, designed to operate against a discharge pressure of 1788 psi and to be driven by 1250 hp, 3600 rpm induction motors.

Propelling a Boat Through a Hell of Heat

"The speed control unit is our last opportunity to control the quality of our product," reports the American Electro Metal Corp., manufacturers of parts made of *powdered* metal.

Control of the passage of the metal parts through sintering furnace is the critical element in the quality of the product, so this company uses Worthington Allspeed Selectors to provide flexibility and accurate control of speed.

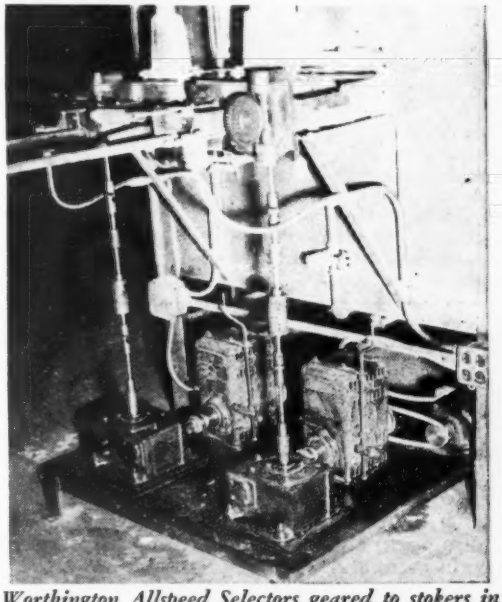
From hydraulic presses which have done the molding, the parts enter the sintering furnace on trays called "boats" which pass through on a stoker. The furnace is 100% pyrometrically controlled to hold constant temperatures up to 2000°F. within a range of plus or minus 5°.

It is necessary to expose the charge to uniform temperature for unjform periods of time. Finished pieces must be accurate within tolerances of .001 in. for some products and .005 in. for others.

Since each mixture requires a different temperature and a different length of heat treatment, the speed of the stoker must be varied to suit each mixture. The stroke of the stoker being fixed, it is necessary to vary its time of travel from a minimum of 3 minutes to a maximum of 60 minutes, depending on the product.

The Worthington Allspeed Selector offers a wide range of speed, with stepless control, ease in adjusting the speed, and a perfect reliability in keeping the set speed constant. The stoker is driven by a ¼ hp motor which operates at 1700 rpm. A small V-belt driven pulley connected with the Allspeed Selector reduces the speed in the ratio of 1 to 1½. The driven shaft of the selector is geared to the stoker.

The user reports that since the installation of Worthington Allspeed Selectors on the air furnaces, the troubles previously encountered with completely manual operation have ended.

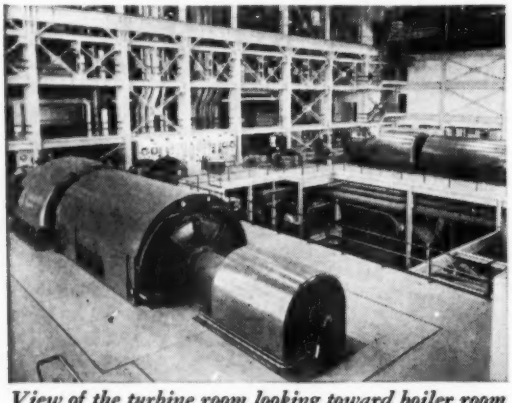


Worthington Allspeed Selectors geared to stokers in sintering furnaces used by American Electro Metal Corp., Yonkers, N. Y.

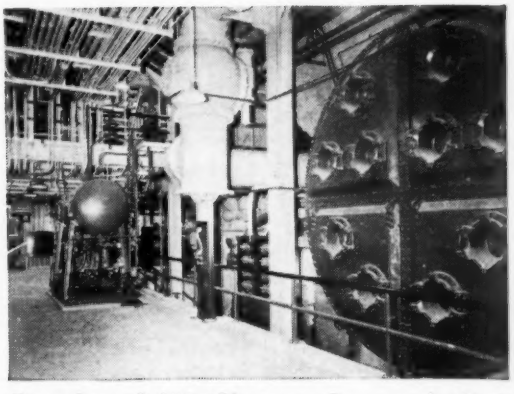
NEWS from the power front

Three Views of Expansion at Baltimore's Riverside Station

An artist retouched this photograph to show the eventual appearance of the Riverside Station of Consolidated Gas Electric Light and Power Company of Baltimore. Foundations and steel construction are in progress for the third 60,000 kw turbo-generator unit, using Worthington 46,500 sq ft condensers, 25,000 gpm vertical circulating pumps, condensate pumps, air compressors and deaerating feedwater equipment.



View of the turbine room looking toward boiler room with No. 1 Unit in background. The nozzle head water box of the Worthington condenser is seen through the opening in the operating level. The steam jet air pumps with inter and after condenser are on the intermediate level immediately to the left of the main condenser.



Reversing end of Worthington condenser serving No. 1 Unit is at right. The atmospheric relief valve is at the left of the condenser. This is a 46,500 sq ft two-pass condenser with a spring-mounted, welded steel shell, having an inlet solidly connected to the exhaust neck of the turbine.

Further New Construction at Westport Station

Another new Worthington installation for Consolidated Gas Electric Light and Power Company is being made at the Westport Station, where the No. 3 unit has a Worthington 46,500 sq ft condenser and a deaerating heater. The condenser for the No. 4 unit will be larger —55,000 sq ft.

In a Year and a Half the Diesel Was Free

Zinsser & Co. Inc., a chemical plant located in Hastings-on-Hudson, N. Y., has been keeping close track of the comparative cost of producing and purchasing current.

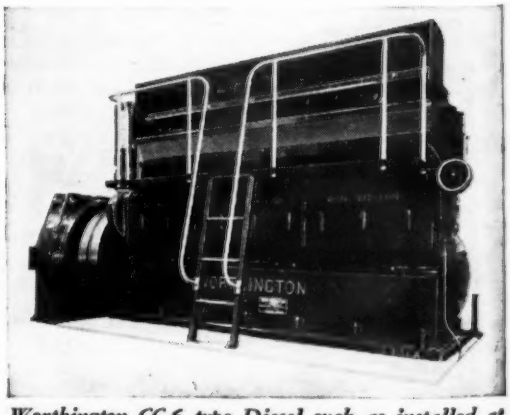
In one year and a half a Worthington Diesel Engine saves enough on the cost of power to equal the cost of the installation.

Maintenance cost is low, attributable in part to the design of the engine and in part to the careful attention given it by the owner, including regular check-ups and routine maintenance at short intervals.

The power house engineer reports particular satisfaction with the governor on the Worthington Diesel. He reports that "the electric clock does not gain or lose more than five minutes a week as an average."

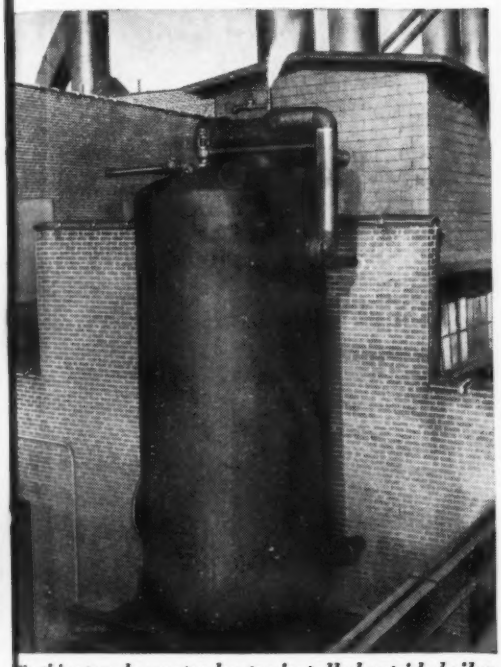
The type of fuel system used on Worthington engines contributes to the good regulation. Direct injection with individual fuel pumps for each cylinder allows the engine to respond immediately to changes in load under the control of the governor.

The Worthington Diesel installed ten years ago was joined by a second Worthington engine during the war when the demand for Zinsser chemicals increased.



Worthington CC-6 type Diesel such as installed at Zinsser & Co.

Worthington Pump and Machinery Corporation
•
Harrison, N. J.



Worthington deaerator heater installed outside boiler room in New England paper mill.

Unusual Installation of Deaerator Heater

In a New England paper mill, lack of headroom inside the boiler plant required the feedwater deaerator heater to be installed outside the building.

The unit is a 180,000 lb-hr Worthington steam jet deaerator. Large pipe connections, one at the top and one at the bottom, are extended through the wall. These connections are flanged.

Regulating valve float housing, overflow valve, overflow float housing, high and low level alarm switches, steam pressure gauge, and water level gauge glasses are all mounted on the 8 in.vertical column in the boiler room, where there is no danger of freezing and where they are visible and accessible to the operator.

Pump Powers Plastic Presses

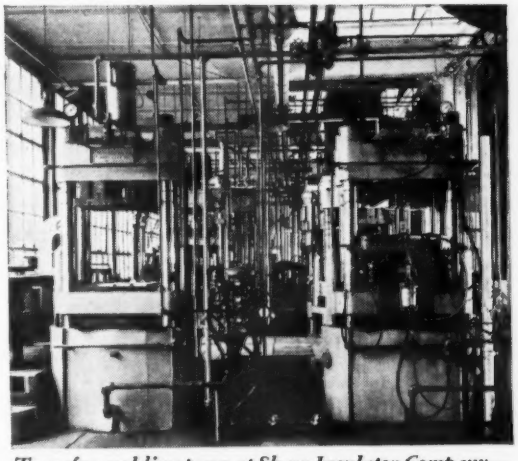
Transfer molding, according to Shaw Insulator Company, is ideal for molding thermosetting plastics objects which may be difficult to produce on conventional compression molds. Non-directional uniformity of strength, handling delicate inserts, intricate sections, variable walls, etc., and high speed press operation are important gains resulting from this process.

By this method, the material, instead of being loaded directly into the mold cavity, is first subjected to heat and pressure in a transfer chamber. After plasticizing, it is forced through an orifice directly into a closed mold and made to flow into all parts of the mold to a state of uniform density. It is held under pressure until cured.

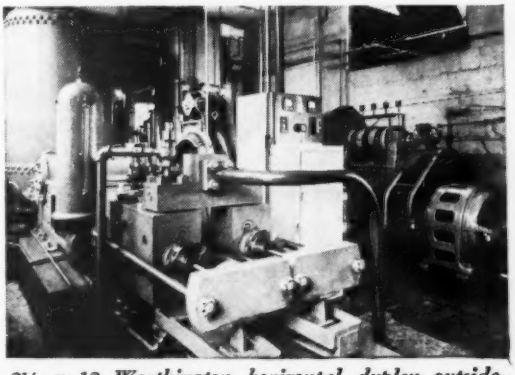
Shaw Insulator Company uses a 2¼ x 12 Worthington horizontal duplex power pump and a 2-UB-1 2-stage centrifugal pump (the latter for low pressure work) to supply hydraulic pressure for operating the molding presses. The variety of presses ranges from 20 to 500 tons and they operate on cycles from 30 seconds to four minutes. Closing is done on low pressure, and the high pressure is added, after the press has closed, for the final squeeze which is held during the cure.

The Worthington horizontal duplex pump is fitted with synchronized suction valve unloaders and is direct-driven by a 100 hp 450 rpm synchronous Electric Machinery motor. It operates against a pressure of 3000 psi and delivers a capacity of 52 gpm.

Pump performance is termed "excellent". The pumps operate 24 hours daily on a five-day week, and no shutdowns have been experienced. This company also operates a 9 x 9 HB compressor made by Worthington.



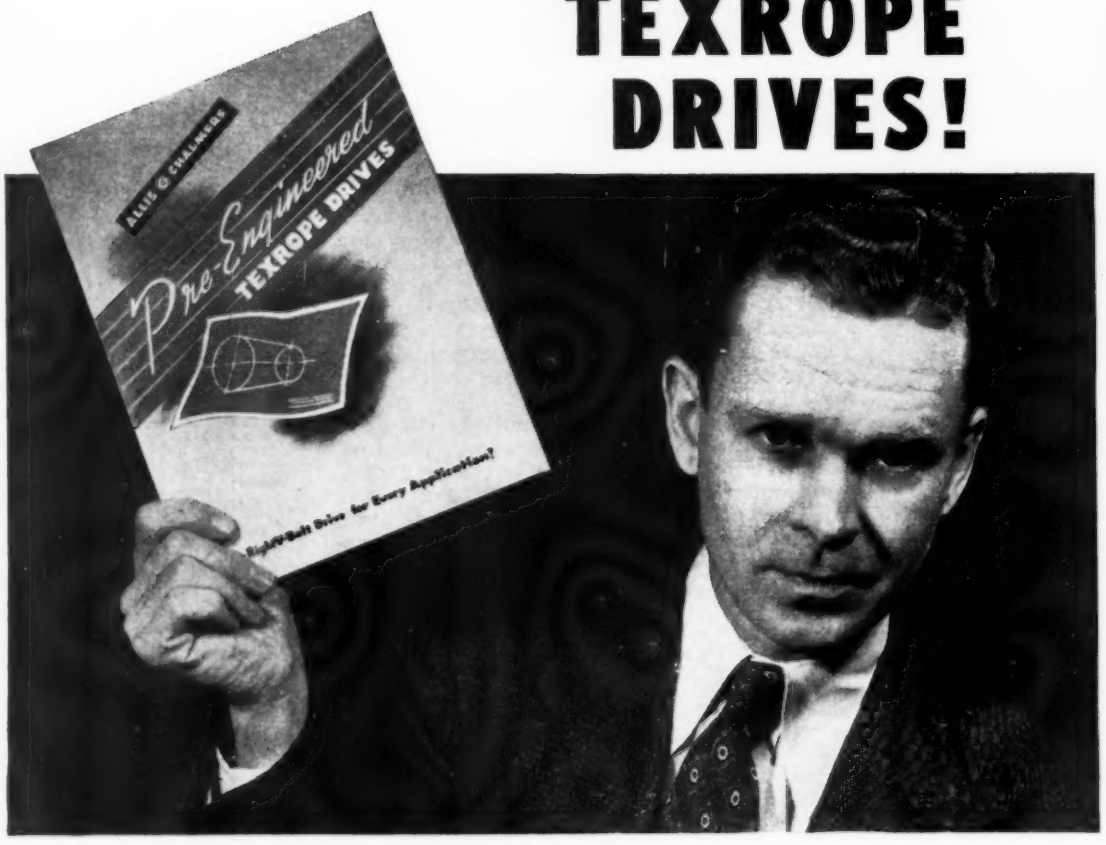
Transfer molding press at Shaw Insulator Company—hydraulic power supplies by Worthington pump.



2¼ x 12 Worthington horizontal duplex outside-packed KUF plunger pump at Shaw Insulator Company.

NEW MANUAL PRESENTS

Pre-Engineered TEXROPE DRIVES!



Selects Most Economical Drive for Any Installation!

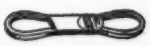
NEVER BEFORE has specification of the *right* V-belt drive been made so simple, so unerring. You turn to a page, run down a column, and there, in *one place* is the drive you need . . . number of grooves, diameters of sheaves, size of belt. No turning from table to table, no figuring.

These *Pre-Engineered* stock Texrope drives cover 90% of all requirements. Texrope engineers have carefully selected each one, using economical *stock* belts and sheaves. Each selection is the *one best drive* for a given requirement of power, speed and dimension.

For the few cases not covered by *Pre-Engineered* stock drives, the manual provides complete, carefully arranged engineering data to make it easy to figure special drives.

Now Available . . . 144 pages, indexed, size 8½ by 11 inches. The most complete V-belt drive manual ever published. A book that only Allis-Chalmers can give you. Copies have been sent to many Texrope dealers and users. If you have not received one, write for Texbook No. 20P40. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 2333

TEXROPE .. Greatest Name in V-Belt Drives



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Five Types — Sizes to suit every power transmission job.

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— sheaves in a full range of sizes, grooves.

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Exact variations in speed, stationery or motion control.

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Speed variations up to 375% at the turn of a crank.

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One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

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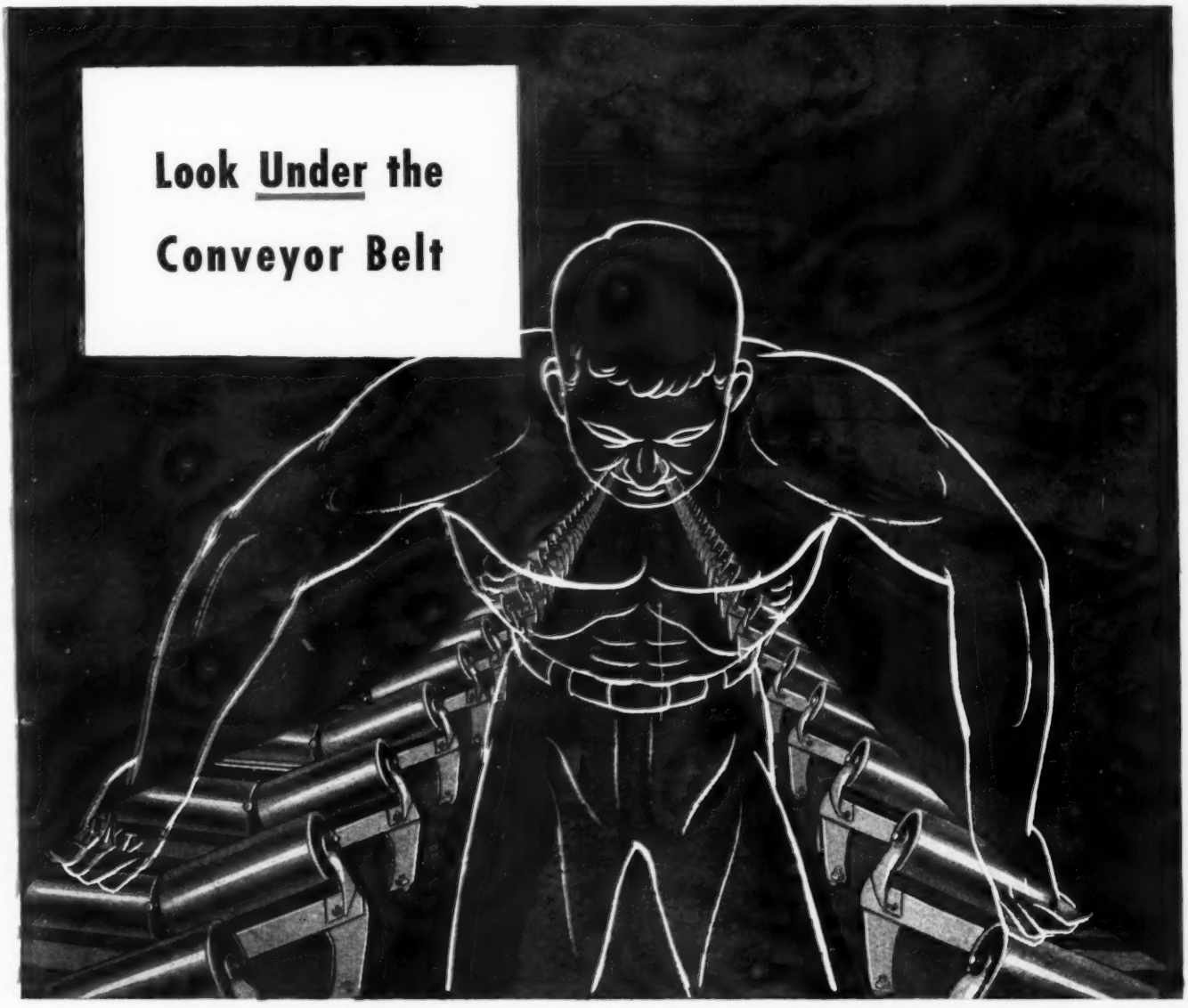
A CENTURY OF SERVICE to Industry THAT MADE America Great



Two belt conveyors handling different sizes of stone at Granite Rock Company. Both belts ride on S-A PACIFIC Carriers.

A belt conveyor is as efficient as the carriers

A glance *under* the belt will help you to judge the overall efficiency of a belt conveyor system. If the carriers you see are Stephens-Adamson's dependable PACIFICS, you can take for granted that the system is built to handle bulk materials fast, economically and with the least possible maintenance expense.

These carriers have been built to take the pounding of thousands of tons of material daily because of these design and construction features:

- Carrier of heavy gauge steel and malleable iron with roller assemblies interchangeable.
- Timken tapered roller bearings at each end of rollers, housed in a steel inner tube.
- Each bearing protected against dust and moisture by close-fitting labyrinth grease seals.
- Pressure lubrication direct from individual fittings to each bearing ...retaining cups in inner tube hold enough grease for long periods.

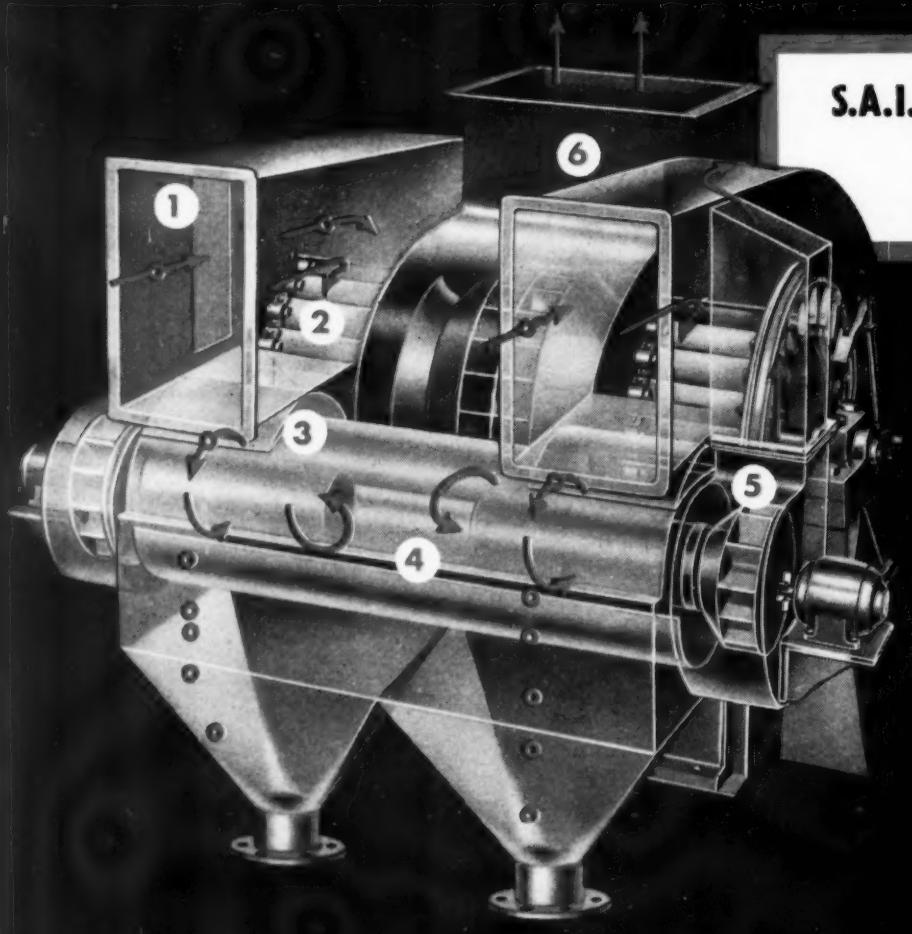
For benefits like these, specify PACIFIC Carriers for your conveyors. Remember, too, that S-A builds carriers of many types to fit every type of service.

STEPHENS-ADAMSON MFG. CO.

5 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. • BELLEVILLE, ONT.

Designers and Manufacturers of All Types of
BULK MATERIAL HANDLING EQUIPMENT

1 UNIT THAT DOES 2 JOBS



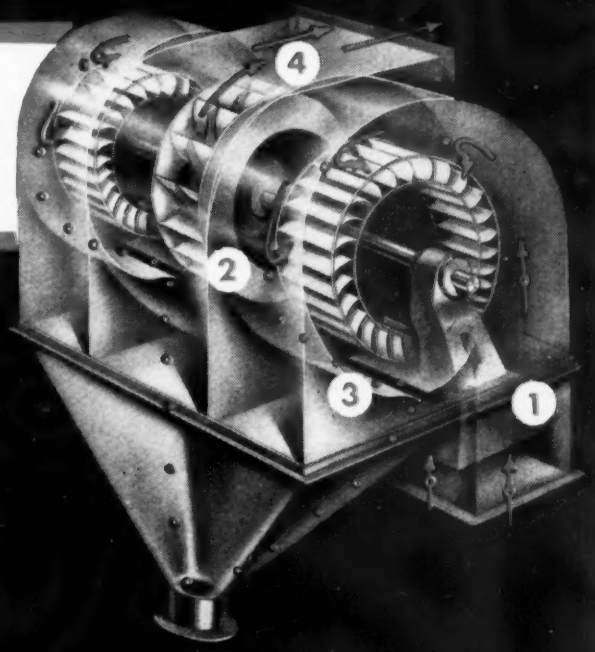
S.A.I.D. DESIGN 3

For handling small-particle fly ash from pulverized coal, as well as stoker dust.

1. Dust-laden gas from boiler enters fan inlet.
2. Separating vanes in spiral inlet box cause sudden reversal in direction of flow—dust particles separated by momentum and concentrated around outside of inlet scroll.
3. Concentrated dust and portion of gas is drawn through shave-off into auxiliary collector.
4. Horizontal cyclone separates dust and deposits it in hopper.
5. Auxiliary fan returns dust-free gas to inlet housing.
6. Clean gas drawn through separating vanes to induced draft fan, is discharged to stack.

S.A.I.D. DESIGN 4

Especially designed for handling the relatively heavy dust particles from SPREADER STOKER FIRED BOILERS, without the use of an auxiliary collector.



1. Dust-laden gas from boiler enters fan inlet.
2. Dust particles are separated by momentum as gases reverse direction through separating vanes in spiral inlet box.
3. Concentrated dust particles are shaved off at bottom of inlet scroll and deposited directly into hopper.
4. Clean gas drawn through separating vanes to induced draft fan, is discharged to stack.

and OFFERS 3 BIG SAVINGS

The Sturtevant S.A.I.D. Fan provides both Induced Draft and Fly-ash Removal, for the combustion of solid fuels

SAVES SPACE—Can be installed in practically the same space as an ordinary induced draft fan. Allows installation where no provision was made for separate collectors.

SAVES TIME—Reduces "time out" for maintenance, because fly ash is removed *ahead* of the fan wheel.

SAVES MONEY—Initial cost, installation, insulation and duct work held to minimum. Additional horsepower generally less than required for separate collectors.

THE ADVANTAGES of the S.A.I.D. fan—in both immediate and long-range savings—are not matters of speculation. They have been *proved.* In major central station and industrial power plants all over the country, Sturtevant S.A.I.D. fans have chalked up cost-cutting service records—over six years of proved performance with pulverized coal and stoker fired boilers. For complete information on Sturtevant S.A.I.D. fans, write today for Catalog No. 463, Westinghouse Electric Corporation, *Sturtevant Division,* Hyde Park, Boston 36, Mass.

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ELECTRICALLY UNITED

Derived from a combination of two words, *ELECTRically UNITEd,* ELECTRUNITE is the name applied to Republic's complete line of boiler, heat exchanger and condenser tubes, and to the *improved* process of electric resistance welding by which they are made.

Outstanding advantages of ELECTRUNITE Pressure Tubes are faster and easier installation —due to their consistent uniformity of wall thickness, concentricity and ductility . . . and long trouble-free service life—because each tube is strong, sound and free from scabs and slivers, both inside and out.

In the past 15 years, more than 200,000,000 feet of *modern* ELECTRUNITE Pressure Tubes have been installed in countless types of steam generating and heat transfer equipment used throughout all industry. For complete information about the ELECTRUNITE Process and ELECTRUNITE Pressure Tubes, write for a *FREE* copy of Booklet BT-12.

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Get Greater Use from Switches and Panelboards by Installing FUSETRONS

Here's Proof That It Can Be Done

"Fusetrons Saved Us the Cost and Trouble of Rebuilding Our Dust Tight Switch Room"

"Last year when we remodeled our mill and constructed a sizeable addition, we ran into a very serious problem. When this work was laid out, the specifications called for reduced voltage starters which would have permitted us to use 200 ampere, 575 volt switches. The orders for the material were placed and the 200 ampere switches promptly received. But we were told that the delivery on reduced voltage starters would be many months away.

"Reasonably prompt delivery could have been had on across-the-line starters but such starters would have required 400 amp. switches that were too large to fit in our dust tight room.

"Through the use of 200 ampere Fusetrons, instead of ordinary fuses, it was possible to use the 200 ampere switches. This saved us the cost and inconvenience of rebuilding our dust tight room and we believe gives us better protection than we would have had with the installation as originally planned."

DOUGHBOY INDUSTRIES, INC., Milling Division
New Richmond, Wisconsin

E. J. Cashman, President

What is a FUSETRON?

The Fusetron is a DUAL element device — a Fuse to which is added a Thermal cutout.

The result is a fuse with tremendous time-lag and much less electrical resistance.

Fusetrons have the same degree of Underwriters' Laboratory approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses, Fusetrons fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere in both 250 and 600 volt types. Also in tamper-resisting type (Fustats) for 125 volt circuits.

Their cost is surprisingly low.

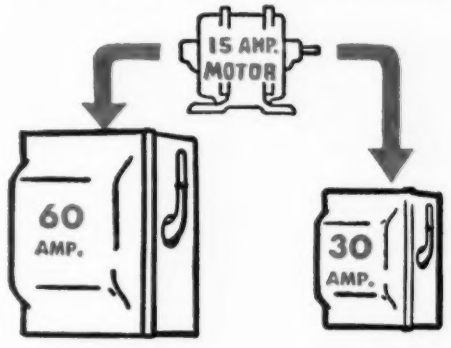
BUSS

SAVE SPACE.. SAVE MONEY *Get Better Protection*

On motor circuits Fusetrons can be used in sizes near to the operating load. That cannot be done with ordinary fuses. It is possible with Fusetrons because they have a tremendous time-lag that prevents them from opening on starting currents or other harmless overloads.

This means that on motor circuits, where Fusetrons are used in the same size as ordinary fuses, more motors or a larger motor can generally be used on the circuit without it being necessary to install a larger switch or panel . . . or for any given load on the circuit, Fusetrons in sizes smaller than ordinary fuses can be used.

For Example:
Take a 15 ampere AC motor on a normal installation.



OVERSIZE

With ordinary fuses, 45 amp. fuses in a 60 ampere switch must be used. The OVERSIZE fuses and switch are necessary to prevent needless blowing on the motor starting current — and you get only short-circuit protection for the circuit.

PROPER SIZE

With Fusetrons you use the PROPER size to give both motor-running and short-circuit protection — or 15 ampere Fusetrons in a 30 ampere switch.

Consider These Advantages of Fusetrons over other Protective Devices

On NEW Installations of Motor Circuits

- Save space because PROPER size Fusetrons permit using PROPER size Switches and Panelboards instead of OVERSIZE.
- More convenient location of switches and panelboards are often possible because of smaller sizes required.
- Save money on fuse replacement costs. By eliminating blowing on starting currents or other harmless overloads, fewer Fusetrons are needed than when fuses are used.

On PRESENT Motor Circuits

- Increase size of motor, or add motors to a circuit without installing a new switch or panelboard. Fusetrons permit a great increase in the actual running load on switch or panel.
- Save cost and trouble of tearing out present switch or panel by replacing fuses with Fusetrons.
- Get fuller use from every switch or panel by using Fusetrons.

Get Many Kinds of Protection Heretofore Not Available by Installing Fusetrons Throughout the Electrical System

*Entirely wipe out needless blows caused by motor starting currents or other harmless overloads. *Give Thermal Protection to Panelboards and Switches. *Prevent needless blows caused by heating in panels and switches. *Permit use of larger motor or adding more motors on circuit without installing larger switch or panel. *On new installations, proper size switches and panels can be used instead of oversize. *Protect motors against burnout. *Give double burnout protection to large motors at little or no extra cost. *Provide simplest way to stop burnouts from single phasing. *Make burnout protection of small motors simple and inexpensive. *Protect coils, transformers, solenoids against burn-out.

Get All the Facts

Get Better Protection — Send the Coupon Now

Even one lost motor or one needless shutdown or one destroyed panel may cost you more than replacing every fuse with a Fusetron. Don't risk such losses, change over the whole plant to Fusetrons.

FUSETRONS
SOLD THROUGH WHOLESALERS

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about BUSS Fusetrons.

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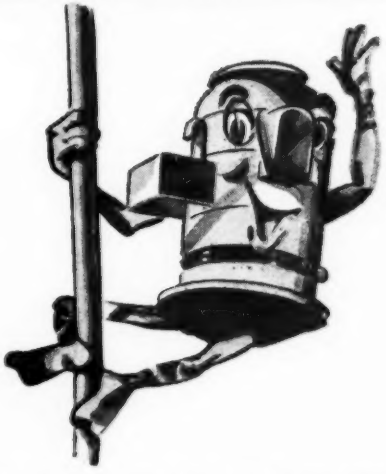
"Which Squirrel-Cage Motor Shall I Buy?"

Open-Type? This general-purpose squirrel-cage motor meets about 9 out of every 10 application requirements; so chances are it's the design you'll select. Allis-Chalmers builds generously proportioned, rugged *open-type* squirrel-cage motors in sizes from 1 hp to the largest practical requirement.

Splash-Proof? Where operating conditions are conducive to entrance of particles or liquids into ordinary motors from either top or sides, Allis-Chalmers *splash-proof* squirrel-cage motors may be your best buy. They're designed to *exclude* top or side directed particles and liquids. Sizes 1 hp to the largest.



Vertical? or Flange-Type? *Either* can solve a space problem. *Vertical* motors (sizes 1 hp to largest) for vertical drives. *Flange-mounted* for side or angle drives. In both types bearings and closures are designed to prevent grease escapement. Mounting flange for attaching to your base can be provided.

Totally-Enclosed? Explosion-Proof? Completely weather-proof and fan-cooled, these motors are built to beat abrasive dust, dirt and corrosive fumes, or moisture conditions that cause windings in ordinary motors to deteriorate. *Explosion-proof type* for oil refineries, paint, varnish or lacquer plants, etc.; Underwriters approved; reduce hazards in explosive or dust atmospheres. Either type built from 1 hp and up.

Are Motor Decisions More Important Today?

YOU BET THEY ARE! One *obvious* reason is the need for keeping costs down. Another is that in the rush to fill demand much equipment is being misapplied; making it harder to maintain profits not alone today, but tomorrow, the next day and the next year—as long as misapplication continues!

That's why it's important to take a good look at motors — their characteristics — your equipment — power source and surroundings — *before* you buy and apply! If you're in doubt, don't take chances — call a motor expert! ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 2327

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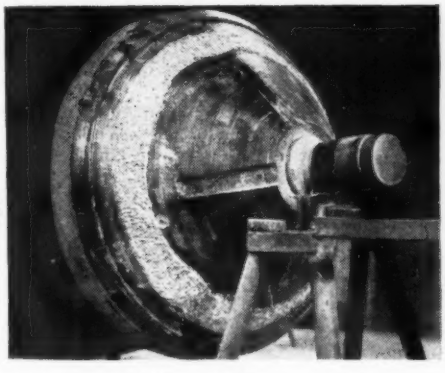
ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment-
Biggest of All in Range of Industrial Products

Replacement of this $1,400 ring gear would have taken from six months to a year. The badly worn teeth were built-up by bronze-welding and the gear returned to service in just a few days at half the cost of a new one.

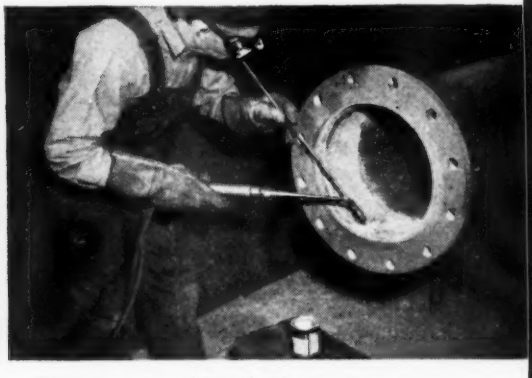
Keeping the "wheels" going 'round

The repair of vast quantities of equipment by oxy-acetylene methods is of course routine for plant maintenance crews. It is for the special job, however, that the LINDE serviceman's supervision and work proves so valuable and gives assurance of success. This skilled, specialized assistance is always available to LINDE customers. Just phone the nearest LINDE office.

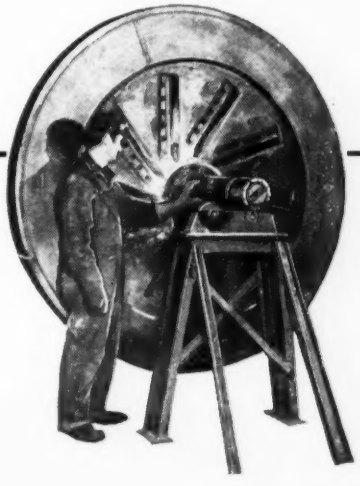


Bronze-welding this cast steel cone crusher head saved $1,000. The crack, which ran completely around the head for a distance of 9½ ft., extended through the thickness of the casting in several places. It was veed out by flame-gouging.

This cast iron steam hammer cylinder weighs 4,000 lb. Two large cracks, one on each side of the cylinder wall, were bronze-welded in only 14 hours. A new casting would have taken 16 weeks to obtain and would have cost more than 10 times as much.



Flanges are quickly joined to cast iron pipe sections by bronze-welding. LINDE supplies several bronze rods to meet varying service requirements.



Bronze-welding effected a considerable saving of cost and time when four spokes of this huge cast iron pulp-chipper wheel was cracked at the hub.

Linde

The word "Linde" is a registered trade-mark of The Linde Air Products Company.

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CONTROL...Yes

But HOW EFFICIENT?

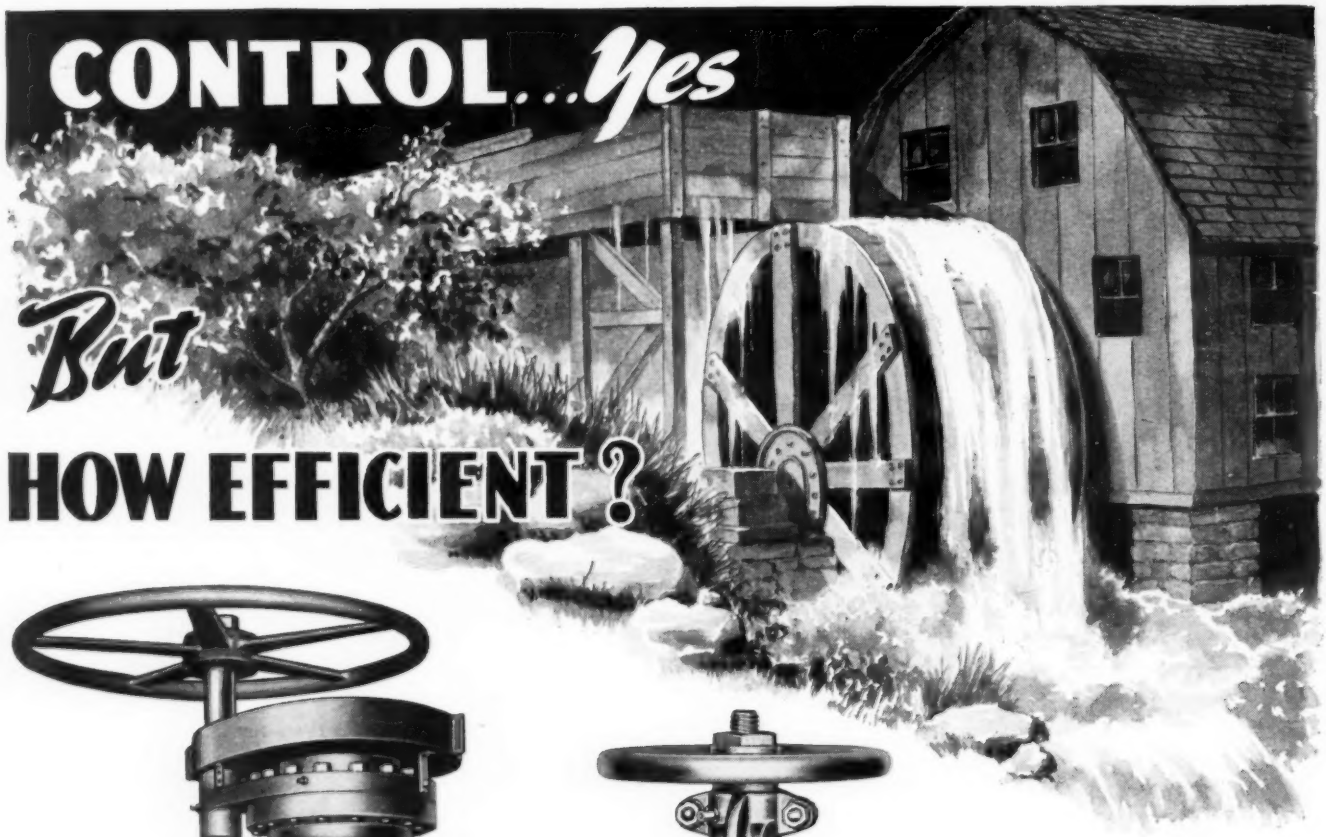

Fig. 19031 W. E.—Class 900-pound Cas Steel Globe Valve with welding ends and POWELL PRESSURE SEAL BONNET. The internal pressure seals body-bonnet joint. Spur gear operated. Stellite faced.

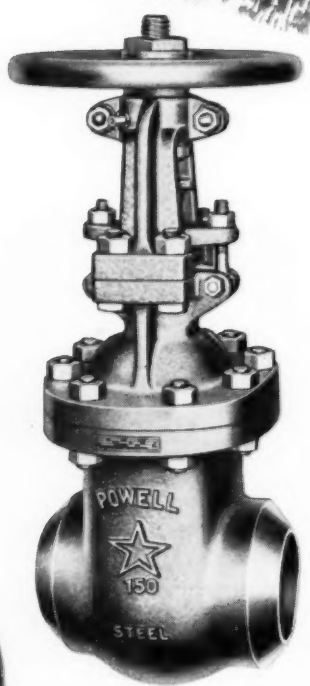

Fig. 1503 W. E. — Class 150 - pound Cast Steel Gate Valve with welding ends. outside screw rising stem, bolted flanged yoke and taper wedge solid disc.

Fig. 241—Large 125-pound Iron Body Bronze Mounted Globe Valve. Made in sizes 2" to 16", inclusive. Has outside screw rising stem, bolted flanged yoke and regrindable, renewable bronze seat and disc.

POWELL

It's a long step from the Old Mill wheel to the modern power plant. Much of the difference lies in the degree of efficiency in flow control.

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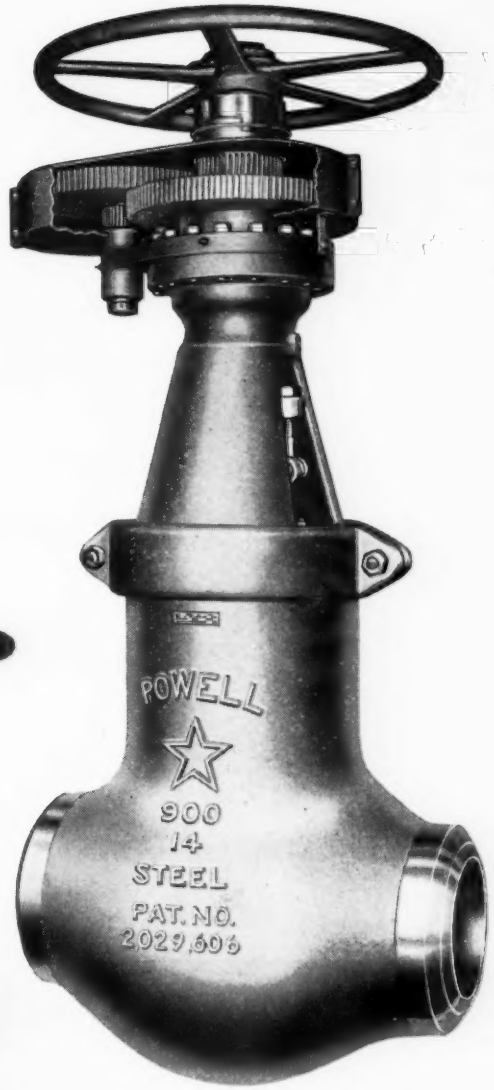

Fig. 19084 W. E.—Class 900-pound Cast Steel Non-return Globe Valve with welding ends and POWELL PRESSURE SEAL BONNET. The internal pressure seals body-bonnet joint. Has compound spur gearing to provide easy operation. Stellite faced.

Fig. 11303 W. E.—Class 1500-pound Cast Steel Gate Valve with welding ends and POWELL PRESSURE SEAL BONNET. The internal pressure seals body-bonnet joint. Thrust bearing yoke. Stellite faced.

Fig. 1793—Large 125-pound Iron Body Bronze Mounted Gate Valve. Made in sizes 2" to 30", inclusive. Has outside screw rising stem, bolted flanged yoke and taper wedge solid disc.

POWELL PRESSURE SEAL BONNET Valves are furnished with plain or thrust bearing yokes, or can be equipped for gear, toggle, or motor operation, depending upon size and operating conditions.

The Wm. Powell Co., Cincinnati 22, Ohio

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A CROSS-INDEX OF SUBJECTS FOR THE MONTH

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STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
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INSTRUMENTS, CONTROLS
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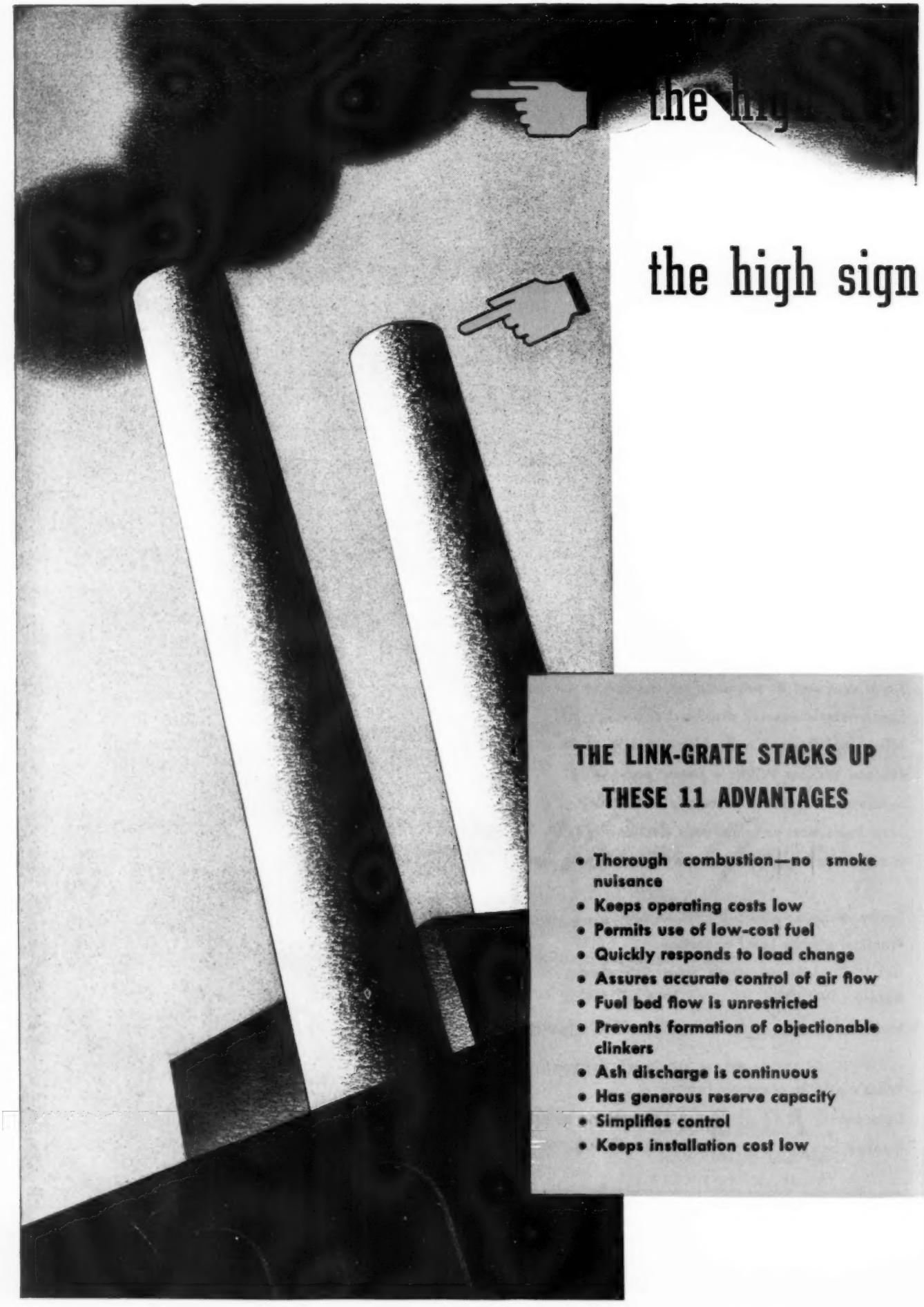

the high sign

THE LINK-GRATE STACKS UP THESE 11 ADVANTAGES

- Thorough combustion—no smoke nuisance
- Keeps operating costs low
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- Assures accurate control of air flow
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- Prevents formation of objectionable clinkers
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efficient combustion

of a *Link-Grate* stoker

Smoke Abatement is Waste Abatement with a Westinghouse Link-Grate Stoker

You'll get less smoke—and, of course, more power—per pound of coal with a Westinghouse Link-Grate Stoker. That's been proved in one installation after another . . . and it's a fact that will win approval from your own fuel cost sheets, from the Smoke Inspector and your neighbors.

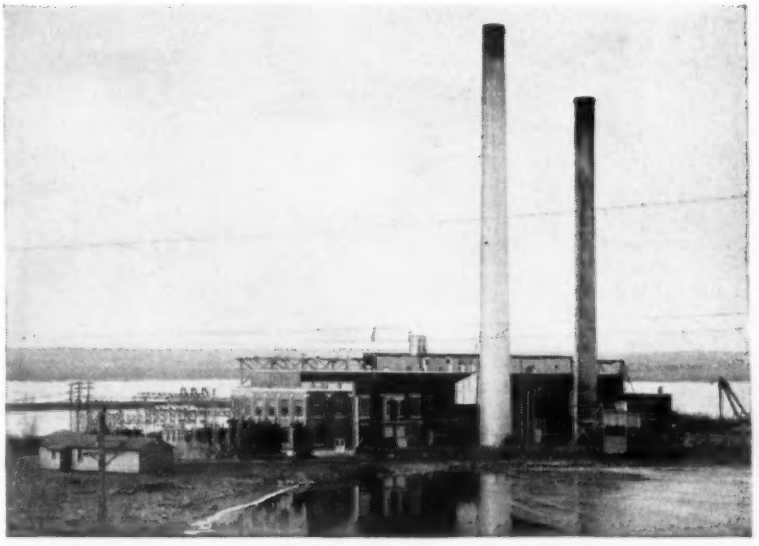
The Link-Grate action does all this by maintaining a regular combustion rate because it continuously processes the fuel bed to keep it porous. With this action, positive motion at the rear of the stoker permits uniform flow of coal over the underfeed section to keep the burning lanes open.

In Link-Grate action, the grates first hinge up to break open the fuel bed and let low pressure air flow through the grates. The reverse movement of the grates crumbles and conveys the burning fuel.

Because of this conveying movement of the Link-Grate, ash comes off the ash discharge plate continuously—doing away with periodic dumping and reducing labor. Clinkers are not a problem.

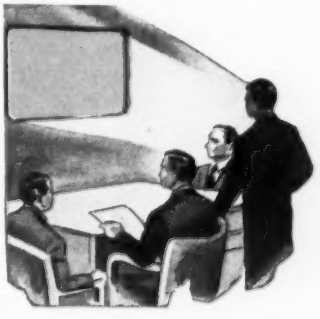
Since the fuel bed is always porous, the Link-Grate Stoker can meet suddenly increased steam demands quickly with full combustion efficiency.

Get the complete information about the Link-Grate before you make an investment in stokers. If possible, see one in operation. Your nearest Westinghouse office will be glad to arrange an appointment with a user. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-50469



Almost no smoke is coming out of the stacks although the boilers are in operation at this power plant of the Lake Superior District Power Co. at Ashland, Wisconsin. In this installation are two 6-retort, SDL-29 Link-Grate Stokers. (Photograph is not retouched.)

Show Link-Grate Movies in Your Own Office. A 15-minute sound moving picture has been produced to show in detail the operation of a Link-Grate Stoker. Whether you can visit an actual Link-Grate Stoker in operation or not, this interesting 16 mm. film will show you its action and explain its points of superiority while you sit at your desk. To borrow a print of this film for your own private showing, write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.



Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Link-Grate STOKERS

Here's a "PROGRESS REPORT" on a Snow Melting System with BYERS Wrought Iron Pipe

Many engineers, when they hear about a snow melting system, ask "Does it *really* work?" The picture provides a convincing answer.

The view shows a portion of a 600-foot driveway leading from the plant of American Cyanamid Company, Bridgeville, Pa., to the main highway. Two lengths of Byers Wrought Iron pipe were installed under each wheel track, welded into headers at each end, then covered with concrete paving. Water, with anti-freeze solution added, is heated to 165° F. by a steam-fed converter, and circulated through the pipes by pumps.

A 13-inch snow last winter gave the installation its most severe test to date. As can be seen, the system kept the roadway clear of snow and ice, and eliminated the car stalling and traffic delays that would otherwise have occurred at shift changes.

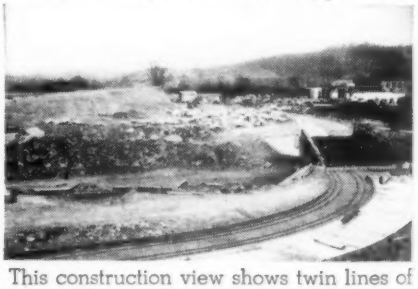
The corrosion resistance of wrought iron, important in all installations, was vital here. The engineers wanted to avoid the use of a gravel foundation. Since the soil in certain areas was acid, a corrosion-resisting pipe material was the only practical solution.

The reason for wrought iron's excellent service qualities is found in the unique structure and composition of the material. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" corrosive attack. The fibers also help to anchor the initial protective scale, which shields the underlying metal.

If you would like added details on snow melting systems ask for Case Study No. 4.

A. M. Byers Co., Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

A 13-inch snow fall was easily handled by the installation. It is designed to handle 1-inch of snow, or .1-inch of ice, per hour.



This construction view shows twin lines of Byers Wrought Iron pipe laid in left hand lane; concrete has been poured in other lane.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • NOVEMBER 1947 • ESTABLISHED IN 1882

SOMETHING NEW HAS BEEN ADDED

MANY POWER readers have by this time heard of the new magazine, *Operating Engineer*, and perhaps have seen one of three "pilot" issues being brought out this fall. When, in January, this new publication starts its full-fledged career, it will represent culmination of a ten-year program to produce a better service for *all* power engineers. Here's the story behind it.

Back in 1937, POWER's editors realized the need for special attention to the operator's problems, particularly in the small plant. Out of their studies grew the "Operating Engineer section" of POWER, a magazine within a magazine. From the beginning, it was viewed as a potential running-mate for POWER. And as the section developed, it gave the editors a chance to learn what information operators needed and how they wanted it.

The war delayed birth of the new magazine, but gave further opportunity for testing and refining. Now with this experience behind them, the editors launch *Operating Engineer*, confident that it will meet the needs of the many power engineers chiefly concerned with day-by-day operating problems.

How will *Operating Engineer* affect POWER? The answer is—*very little.* POWER's basic editorial objective has not altered one whit—we still aim to produce the best possible publication for the men who design, operate and maintain the power services.

To understand why giving birth to a new magazine leaves the parent so little changed, remember that POWER today serves a wide range of reader interests, job responsibilities and plant types and sizes. Now *Operating Engineer* will meet the needs of those *directly* concerned with operation and maintenance, making down-to-earth "how" information available to a wider circle.

This will permit POWER to concentrate on serving the large number of engineers in plants of medium and large size. Their training is compounded of formal education and hard-knocks experience. Their job responsibilities may be channeled specifically toward design, operation or maintenance, but many have assignments embracing all three. They are intensely practical, but background and breadth of responsibilities give them a keen interest in ideas. They want to know "why" as well as "how."

As they always have, these engineers will seek three basic services from their publication: (1) practical help in the bread-and-butter phases of their jobs, as found in POWER's many service departments and know-how articles (2) constant re-education in fundamentals and frequent reviews of current practice, as presented in POWER's educational series and the now-famous "special sections", and (3) prompt and informed reporting of significant developments and new ideas, as covered in POWER's pioneer articles on atomic energy, gas turbines and other advances.

The slightly different emphasis that will mark POWER's future editorial content reflects the moderate shift in the "center of gravity" of its readership resulting from birth of *Operating Engineer*. The most noticeable physical change in POWER will result from removal of the "Operating Engineer section" and with it many familiar departmental titles. In their place will be new departments, specifically designed to serve the job needs of power engineers. Here's the lineup:

POWER ENGINEER'S NOTEBOOK—plant-tested ideas for improved *design*, operation and maintenance.

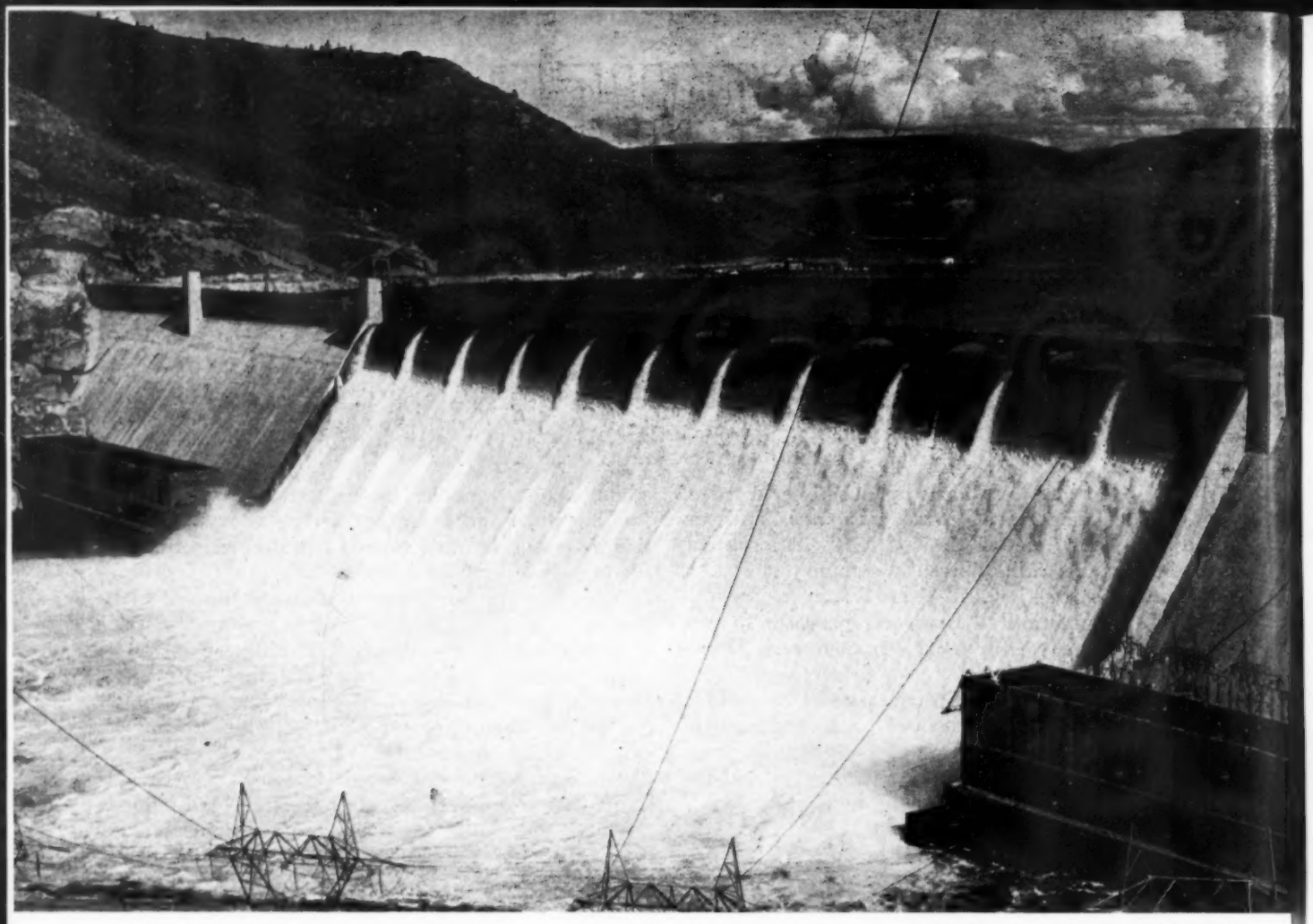
PROBLEMS FROM THE PLANT—Questions selected for special interest to POWER's audience.

POWER-ENGINEERING DIGEST—An easy-to-read summary of what's new in the power field: digests of technical papers, articles in domestic and foreign journals, reports from *McGraw-Hill World News*.

FUNDAMENTALS OF ELECTRONICS — This "refresher course" will be followed by others on engineering materials, diesel engines, etc.

The special sections pioneered by POWER and shown by reader acceptance to be the most popular editorial feature ever devised, will be carried forward in constantly improved style. In addition, POWER's editors plan a new service—special surveys on subjects of pressing interest. First of these will be an authoritative analysis of the fuel situation (coal, oil, gas and synthetic fuels) designed to answer the many questions now plaguing designers and operators.

To sum up: the POWER of the future will be much like the POWER of today, but even bigger, better, and more closely tuned to its readers' interests and needs. Advent of *Operating Engineer* does *not* mean that there will be one practical magazine (OE) and one theoretical magazine (POWER). Both will be 100% practical, differing only in the job functions and interests of their readers. Furthermore, birth of *Operating Engineer* does not change the field covered. *Both* publications cover the same range of subjects, which is identical with the field POWER has served for over 60 years—generation, transmission and application of the power services in all industries.



GRAND COULEE DAM and power plants, one at each end of the dam. During floods, flow over the spillway between the two plants has been 400,000 cfs, which under the available head at the dam is equivalent to about 15,000,000 hp

Grand Coulee: 3,000,000-HP Hydroelectric Power Project

An up-to-the minute report reveals six 165,000-hp units in operation, six more ordered or being installed. When a Power editor visited the plant recently, each unit in service was loaded to 125,000 kw, a total of 750,000 kw. Water flow over spillway at that time equaled 7,000,000 hp under the available head

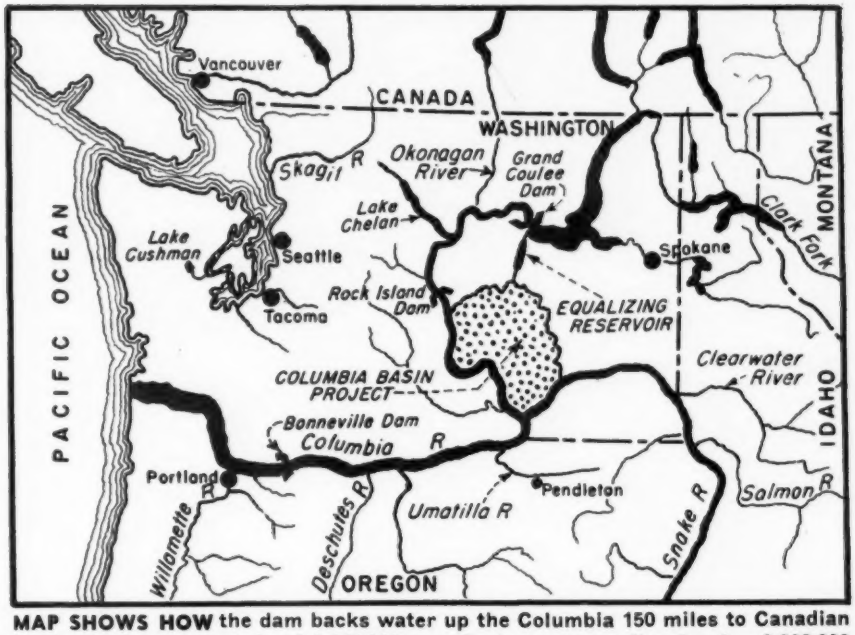
▶ AMONG GREAT POWER DEVELOPMENTS, Grand Coulee stands in a class by itself. It has the largest concrete dam in the world, the greatest power installation, the most powerful hydroelectric units, and the largest pumping plant with highest-capacity pumps and motors. Designed by and built under the direction of U. S. Bureau of Reclamation, it is also part of the world's largest irrigation project. With two-thirds of its total 3,000,000-hp capacity installed or on order, there is much of interest in an up-to-date story of this monument to American engineering and construction genius.

Grand Coulee Dam, on the Columbia River, 94 miles northwest of Spokane, Wash., is the uppermost of eleven great dams proposed to develop the river and harness 92% of the 1290-ft fall from the Canadian border to tidewater near Portland, Ore. At its site, flow normally varied from 17,000 to 492,000 cfs, amounting to an annual runoff of 80,000,000 acre-ft. In the flood of 1894, flow reached 725,000 cfs.

Irrigation Project. Geologists tell us that 25,000 years ago a great ice cap came down from Canada and blocked the Columbia below the present site of Grand Coulee Dam, shown on map on facing page. Behind the ice dam a large lake formed that overflowed its canyon wall, 700 ft above normal river level. The river was forced into a new course that cut a great gorge now known as Grand Coulee. From this

gorge about 30 cu mi of silt spread out over flat country, indicated as "Columbia Basin Project" on the map. When the ice dam melted, the river returned to its former channel, and left a gorge about 50 mi long, 2 to 5 mi wide, 600 to 1000 ft deep, and 600 ft above river level at the site of Grand Coulee Dam.

While the silted area is fertile land with long growing season, it lacks sufficient rain to support agriculture, so the Dam will provide the necessary water. For this purpose, two dams are being built across Grand Coulee to form a balancing reservoir into which irrigation water will be pumped from the great storage reservoir formed by Grand Coulee Dam. From the balancing reservoir, canals will convey water to irrigate 1,029,000 acres of arid land.

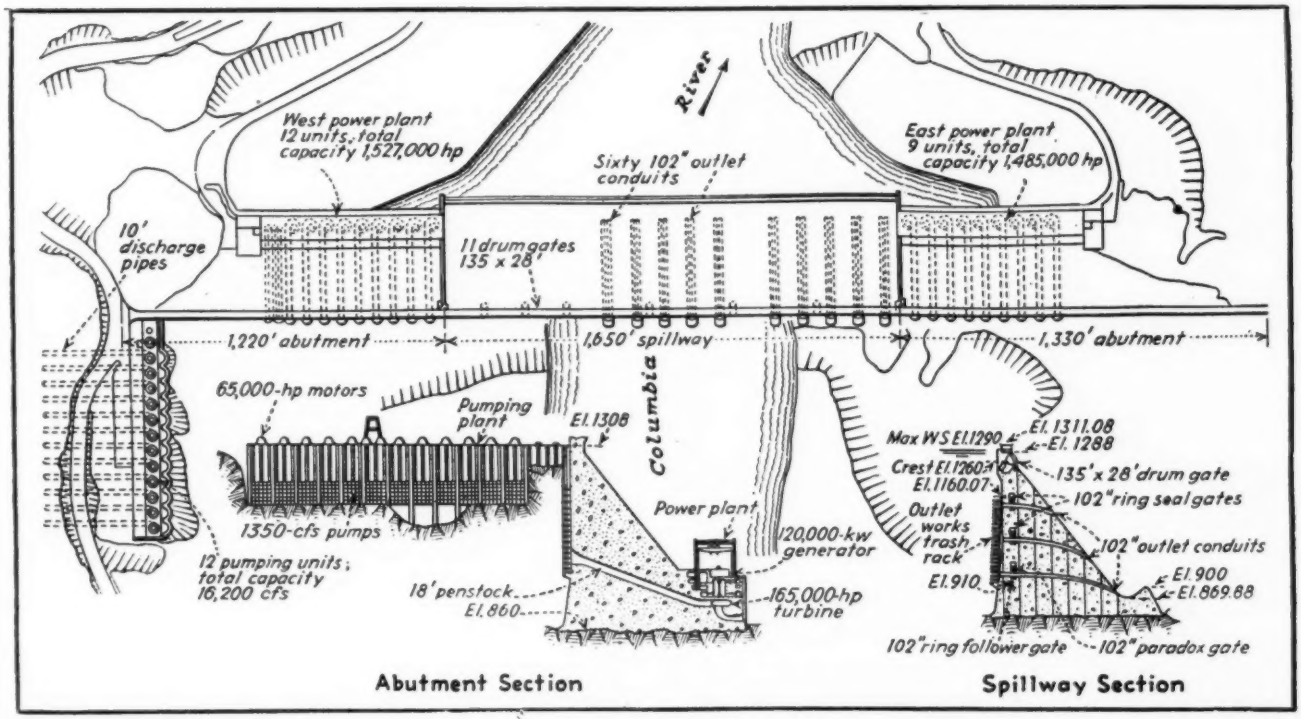


MAP SHOWS HOW the dam backs water up the Columbia 150 miles to Canadian border to form reservoir of 9,645,000 acre-ft storage capacity, develop 3,000,000 hp, and irrigate 1,029,000 acres of land, the latter shown by the shaded area

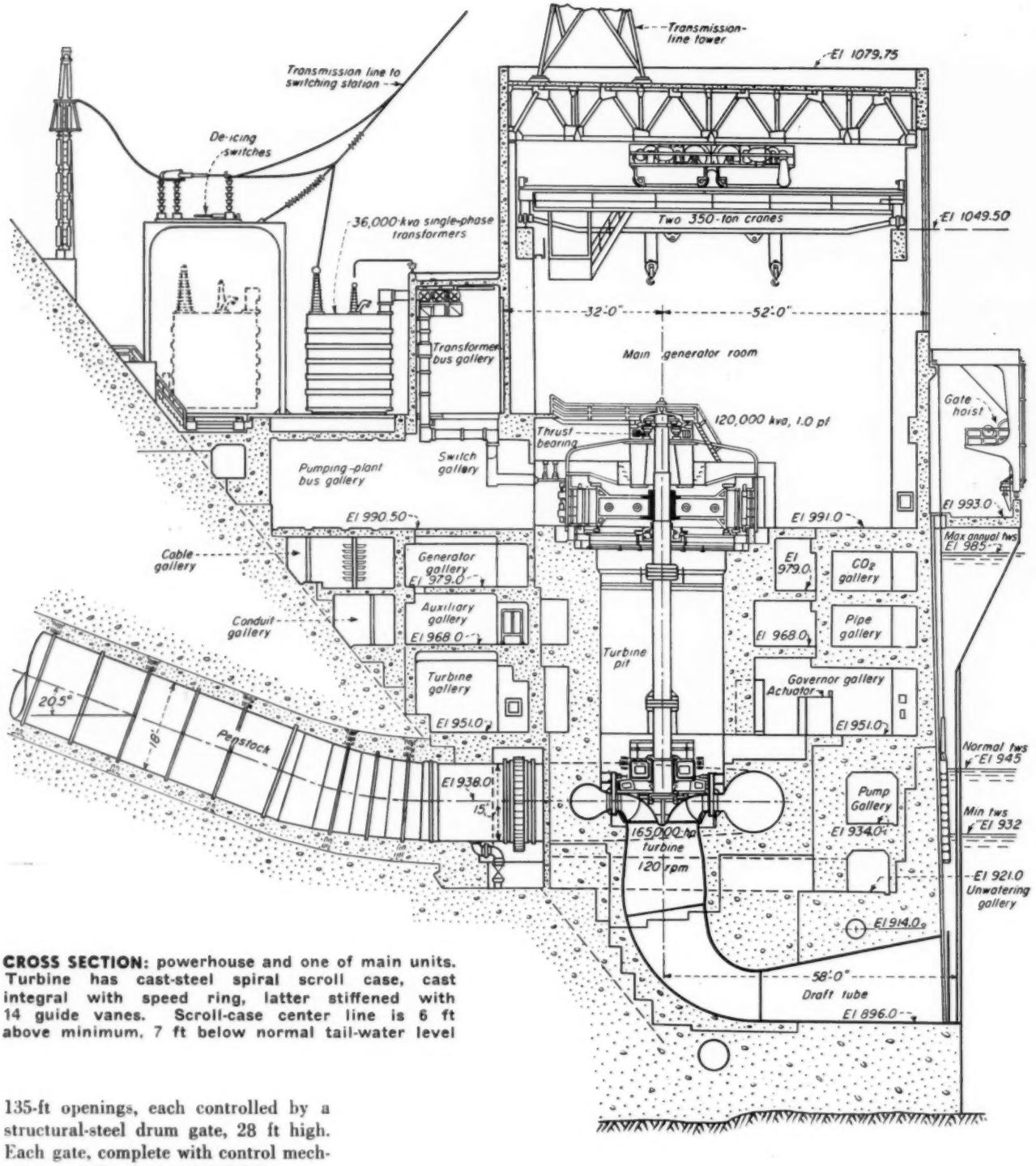
The Dam. To make this irrigation project possible and to generate 13,000,000,000 kwhr annually, the world's largest dam has been built across the Columbia near the upper end of Grand Coulee. It is massive concrete construction of gravity design, 4300 ft long. Getting down to bedrock required excavation of 15,000,000 cu yd of overburden and 850,000 cu yd of rock. The excavated material would fill a hole one mile square, 16 ft deep.

The Dam, shown in the photo on facing page, is 550 ft high from the lowest point of its foundation and 500 ft thick at the base, tapering to 30-ft width at its top, which carries a roadway. The dam alone contains 10,230,000 cu yd of concrete. Powerhouses and other works increase the amount to 10,552,000 cu yd, which weigh about 21,600,000 tons. This amount of concrete would construct a wall 1 ft thick, 3 ft high, and about 20,000 mi long—nearly long enough to reach around the world at the equator.

Spillway and Outlet Works. A section 1650 ft long, designed to pass a 1,000,000-cfs flood, with 30.5 ft effective head on its crest, forms the center of the dam. This spillway contains eleven



PLAN AND ELEVATIONS of dam, powerhouses and pumping plant. Outlet works in dam's spillway comprise 30 pairs of 8.5-ft conduits (two valves each) arranged in groups of 10 pairs at each of three levels, differing in elevation by 100 ft



CROSS SECTION: powerhouse and one of main units. Turbine has cast-steel spiral scroll case, cast integral with speed ring, latter stiffened with 14 guide vanes. Scroll-case center line is 6 ft above minimum, 7 ft below normal tail-water level

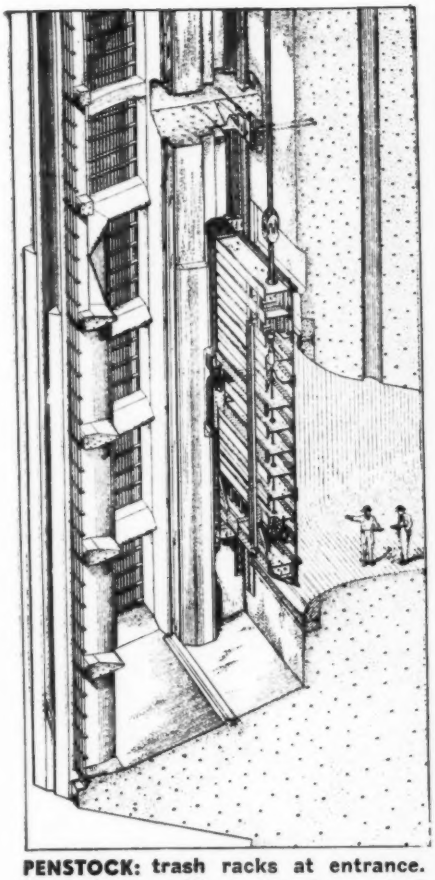
135-ft openings, each controlled by a structural-steel drum gate, 28 ft high. Each gate, complete with control mechanism, weighs about 1,500,000 lb.

Outlet works in the spillway section comprise 30 pairs of 8.5-ft conduits in groups of 10 pairs at each of three levels, differing in elevation by 100 ft, as on p 65, spillway sections of dam. The dam creates a reservoir 150 miles long, backing the water to the Canadian border, 1290 ft above sea level. It provides maximum storage capacity of 9,645,000 acre-ft, 360-ft maximum head, and 5,200,000 acre-ft useful storage with 80-ft drawdown.

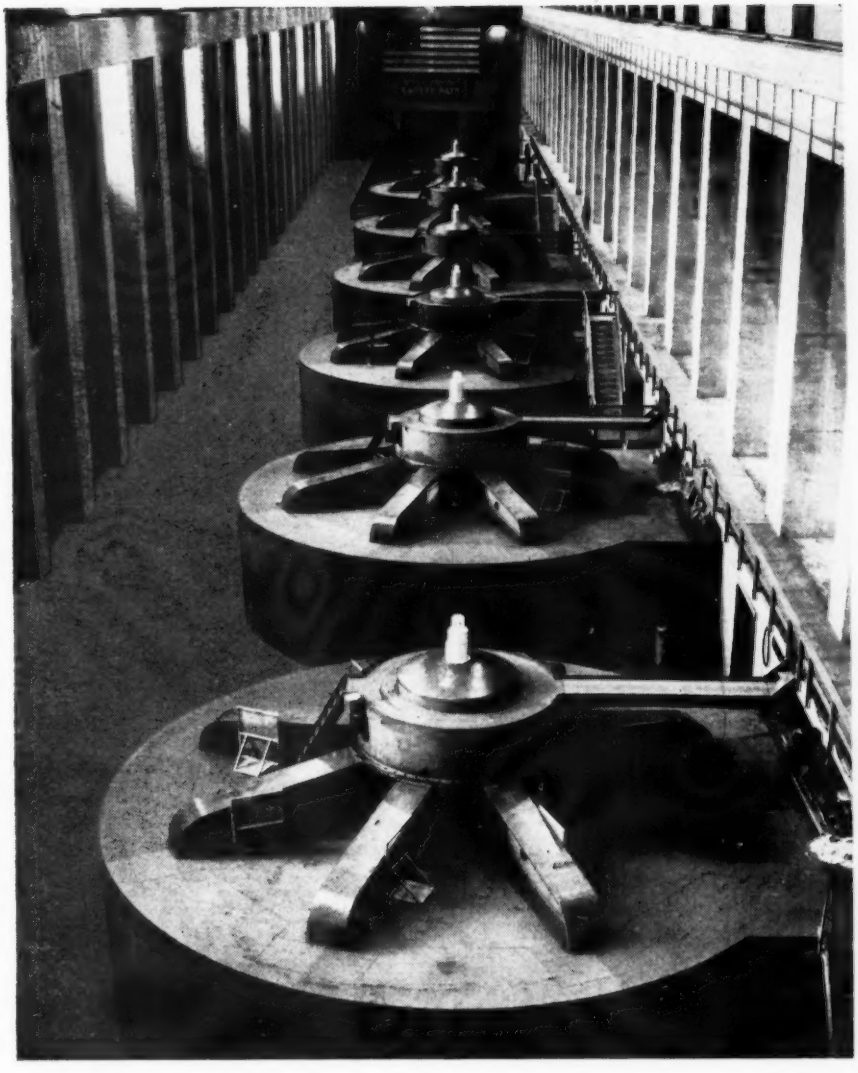
For a dam like Grand Coulee, bedrock is not good enough to build on. Quality of the rock must be carefully investigated for faults that might impair the dam's safety after the reservoir is filled. Diamond-drill holes, which aggregate 33,000 ft—some of them 880 ft deep—proved the rock adequate for the load it was to bear.

Main Turbines. Adjacent to each end of the spillway on the downstream side is a powerhouse designed for nine main generating units. In addition, the west powerhouse will have three 14,000-hp service units. Main turbines, built by Newport News Shipbuilding & Drydock Co (with Woodward governors), are francis type, originally rated 150,000 hp at 330-ft head, and 90,000 at 263-ft minimum head. Operating at 120 rpm, they are the highest-powered hydroelectric units ever built, and have an efficiency above 90% at loads between 106,000 and 150,000 hp.

Cross section through the power-



PENSTOCK: trash racks at entrance. Concrete transition, closed by steel gate, connects dam's upstream face to 18-ft welded plate-steel penstock



SIX MAIN GENERATORS, now operating, are highest-capacity waterwheel generators ever built. Over-all assembled unit, 45-ft dia, stands 22 ft high

house, on p 66, shows one of the main units. Each turbine has a cast-steel, spiral scroll case, cast integral with the speed ring, the latter stiffened with 14 guide vanes. Each scroll case, while being imbedded in the reinforced-concrete substructure of the powerhouse, was kept under 145-psi internal pressure. Center line of the scroll-case distributor is at elevation 938, which is 6 ft above minimum and 7 ft below normal tailwater level.

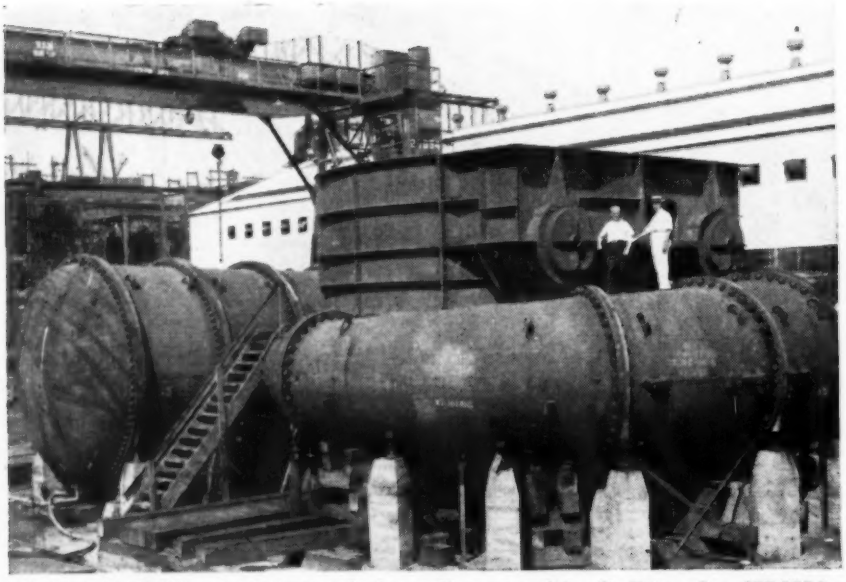
Because of transportation limits, each spiral casing is cast in 14 sections with radial-flange bolted joints. These castings, which have a 15-ft intake diameter and 52-ft maximum diameter across the scroll, are the largest of cast-steel construction. Each weighs 582,000 lb, and the heaviest section 59,000 lb.

The turbine runner, with diameter of 197 in. (16 ft, 5 in.), has 19 vanes and an entrance height of 34⅜ in. It is designed to support its own weight and that of the turbine shaft up to the generator coupling, when resting on the finished ledge in the foundation ring. Each runner can withstand full runaway speed of 220 rpm, under maximum-head conditions, with turbine gates wide open and no load on the generator.

Turbine Shafts. Made of forged, heat-treated carbon steel, each 44-in.-dia turbine shaft is made in two sections. An 18-ft section, which bolts to the turbine runner, has a renewable stainless-steel sleeve divided in halves and secured to the shaft by shrink rings where the shaft passes through the packing. A 24-ft intermediate shaft section connects the turbine section to the generator's 31-ft shaft. Shaft flanges, 75 in. in diameter, form a male and female coupling, and are connected by body-bound, forced-fit bolts, 2.5 to 5 ten-thousandths oversize for their holes. The bolts have axial holes through them so they can be shrunk for removal by passing liquid air through them. They are preshrunk in dry ice for easy installation.

Penstock and Intake Gates. The main units penstocks are welded plate-steel, 18 ft in diameter. They slope at a 20.5-deg angle down from elevation 1041 to 938 near the turbine's inlet where they decrease to 15 ft in diameter. They connect to the turbine casing through a double-acting expansion joint. A 30-in. pipe permits air outflow and inflow when a penstock is being filled and emptied.

An unlined concrete transition section connects the gate openings—15 ft wide by 30 ft high—in the dam's upstream face with the 18-ft steel penstock. These entrances can be closed by hydraulically operated heavy structural- and plate-steel coaster gates under a 264-ft head. These gates travel on dual endless roller trains, running in metal guides their entire length. Gates are made watertight when closed by hydraulically actuated seals. In an



SHOP ASSEMBLY: cast-steel spiral scroll case, with pit liner, for 165,000-hp turbine is built in 14 sections with flanged joints, and weighs 582,000 lb

emergency, these gates can move from open to closed position in about 2 min. Gate-raising time is about 30 min.

Trash racks prevent floating debris from entering the penstocks. Of unusual design, these racks are supported in a 3-sided vertical reinforced-concrete structure that extends, from below the penstock entrance to maximum high-water level, a distance of 275 ft, drawing on preceding page. The racks slide in slots in this structure, and have a total area of 15,108 sq ft. Area of the racks is so large and water velocity through them so slow that it was deemed unnecessary to provide means for racking them.

Main Generators. Turbines connect to 3-phase 13,800-v 60-cycle Westinghouse generators. Originally these machines were rated 108,000 kw, 1.0 pf at 100 C (212 F). To insure stable operation during line faults, they have a short-circuit ratio of 1.75 and 150,000,000 WR^2, flywheel effect. These are the highest-capacity waterwheel generators ever built; the rotor, 31 ft in diameter, weighs 1,175,000 lb. Overall assembled generator is 45 ft in diameter, stands 22 ft above the operating floor. Weight of a complete unit, generator and turbine, is over 3,500,000 lb.

Weight of the rotating element plus the hydraulic thrust, a total load of 2,385,000 lb is carried on a Kingsbury thrust bearing. This bearing has a cast-iron thrust runner, 96 in. in diameter, attached to the top end of the generator shaft. It is designed for a total load of 2,600,000 lb.

Each generator is cooled by a closed system within its housing. On the upper and lower rims of the rotor, blowers circulate air through the machine and eight 2625-sq-ft fin-tube coolers. With 77-F water, seven coolers will maintain generator air at 104 F. Test efficiencies of the generators range from 95.05 at 30,000-kw to 98.4 at 125,000-kw load.

Service Units. Two of the three service units are installed. Each consists of a Pelton Waterwheel Co 14,000-hp 400-rpm francis turbine connected to a 12,500-kva 0.80-pf 60-cycle 3-phase 6900-v generator. Its 14-in. shaft has a 3-in. axial hole for inspection and for air admission to the runners. Scroll case with 5-ft, 4-in. water entrance connects to forebay by a 6-ft penstock.

Excitation. Motor generators powered by the service units excite the main-generator field coils. This method of excitation was selected in preference to direct-connected exciters because six of the generators in the west powerhouse will start and drive the twelve 65,000-hp synchronous motors on the irrigation-water pumps.

Each of the six generators will connect to two pump motors. Before starting, field coils of a generator and its two pump motors will be excited. Then when the generator starts all three units come up to speed in synchronism. Six of these pumps and their motors are on order; the first unit is scheduled for delivery late next year.

Transformers. Each generator connects to a transmission line through a bank of three General Electric single-phase outdoor transformers, with 13,800-v delta-connected primaries and 115,000- or 230,000-v Y-connected secondaries. Generators are not paralleled except through the high-voltage buses in the outdoor switching station.

On test the turbines showed they are good for 165,000 hp and the generators for an equal, continuous load. Because of the favorable performance of these machines the three turbines on order for the east powerhouse are to be rated 165,000 hp and the generators 120,000 kw, 1.00 pf, compared to 150,000 hp and 108,000 kw for the machines in the west plant. Even though their nameplate ratings are different, all turbines are good for over 165,000 hp and the generators for over 120,000 kw, all having been loaded to 130,000 kw continuously. On this basis when all machines, including the three service units, are installed their capacity will aggregate 3,012,000 hp, by far the largest single power installation in the world.

Six main and two service units are now installed in the west plant. Three main units are on order to complete that plant, also three for the east plant —all to be in service by October 1949. This total of twelve main and two service units will give Grand Coulee an installed capacity of 2,008,000 hp, compared to 1,435,000 hp in Hoover Dam plant and 1,200,000 hp in Shipshaw No. 2 on the Saguenay in Quebec. These are the three largest power installations, either steam or hydro, in the world.

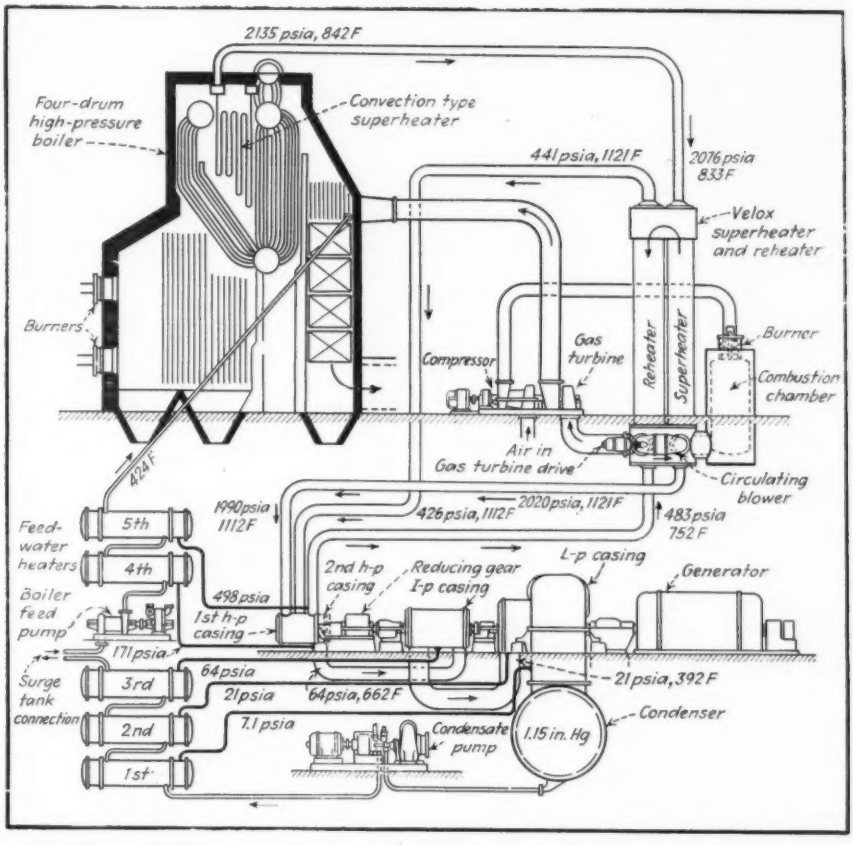
Estimated Costs. All work is under U. S. Bureau of Reclamation. Estimated cost of dam and powerhouses is $228,000,000. Irrigation cost, including pumping plant, will be $352,000,000, making a total investment of $605,000,000, whose repayment is expected to come half from sale of power, and half from settlers on the irrigated land.

The completed power plants, it is estimated, will produce 8,100,000,000 kwhr of primary and 5,000,000,000 kwhr of secondary power. Of the latter, 2,260,000,000 kwhr will be used for pumping flood water during the irrigation season. High-water and irrigation demands coincide so that no primary power or stored water will be required for pumping.

During war years, with total capacity of 798,000 kw the plant supplied loads up to 962,000 kw and its daily output was about 22,000,000 kwhr. From 1942 to 1945, inclusive, Grand Coulee supplied 15,000,000,000 kwhr. It supplied 5,750,000,000 kwhr in the highest year, reaching 600,000,000 one month.

Can Steam-Turbine Stations Profit By Using Higher Temperatures?

Steam plants as well as gas-turbine plants can achieve better performance by raising temperature, says Dr Adolphe Meyer, chief consulting engineer, Brown, Boveri & Co. He demonstrates here proposed designs and discusses problems of selecting materials



PROPOSED LAYOUT of 50,000-kw plant, with 1112-F 1991-psi initial steam conditions, uses Velox-type superheater and reheater and a 4-cylinder turbine

▶ MUCH HAS BEEN HEARD about the desirability of raising inlet-gas temperatures of gas-turbine plants to bring them within practical limits of thermal efficiency. Experience with these units has shown they can be safely operated at temperatures of 1112 F and probably somewhat higher. It is logical to investigate what such temperatures would do for a steam-turbine plant.

Practical Design. After studying several alternative schemes, we selected the one outlined here as the most practical. The heat-balance diagram is shown in considerable detail in the drawing on this page. A standard-design boiler commonly used in high-pressure plants produces steam at 2135 psia and 842 F. This eliminates the need of special superheat control in this unit and allows utilizing ordinary steel for superheater tubes. This boiler will be equipped with a large air heater because of 424-F feedwater.

Final superheating to 1112 F and reheating to the same temperature will be done by the Velox-type unit, which is separately fired. Burning takes place under pressure in the combustion chamber, the gaseous products flowing at high velocity through the superheater and reheater. The pressure and velocity result in high heat-transfer rates. An axial-flow compressor produces the pressurized combustion air.

A gas turbine drives the compressor taking its gas from the exhaust of the Velox unit, which is at a relatively high temperature. From the discharge of the turbine the power gas flows to a suitable point in the boiler joining the flue gas of the boiler unit. As an alternate arrangement it may be more convenient to use the power gas, which leaves the gas turbine at about 715 F, to heat the feedwater instead of using the fifth-stage heater.

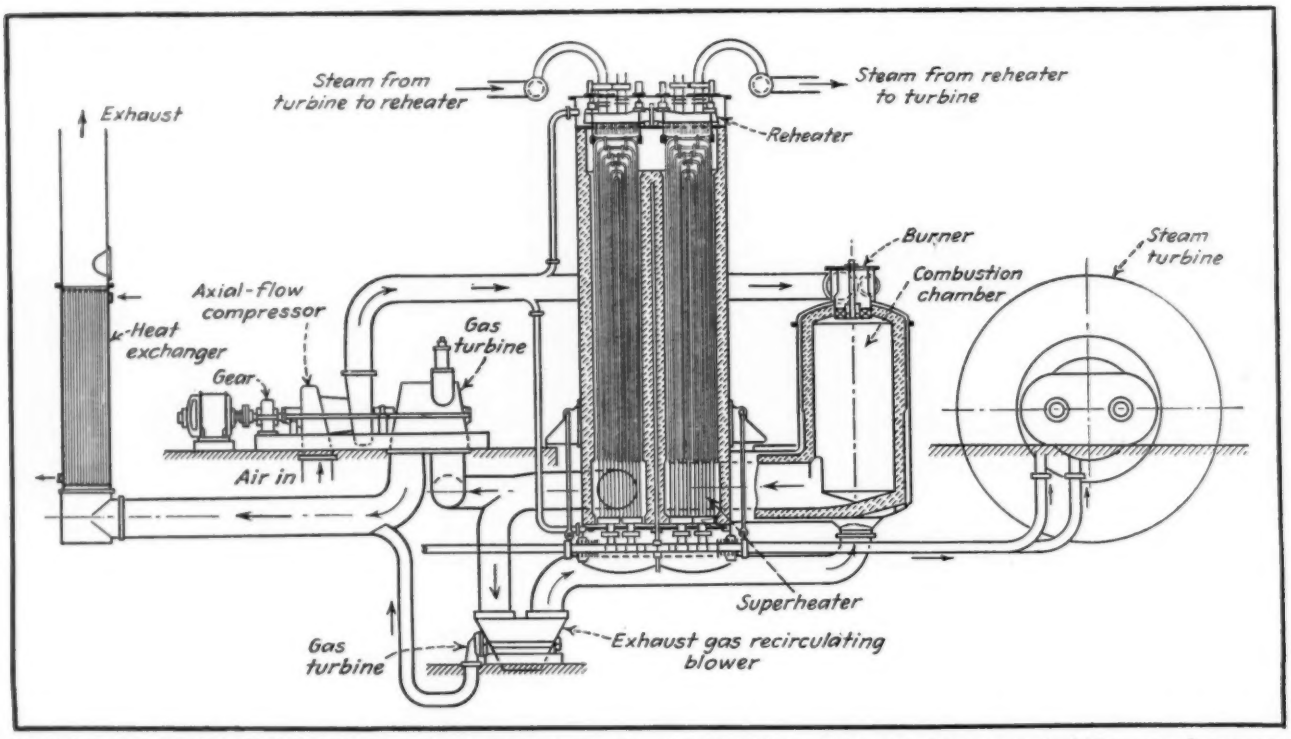
Eight Advantages. To limit maximum gas temperature in the superheater and prevent burning the superheater tubes the combustion gas will be recirculated by an axial-flow blower. This blower has to overcome only the pressure drop through the superheater and reheater. The arrangement has the following advantages:

1. By regulating the burner of the Velox superheater the steam superheat can be controlled independently of both the load and the burning rate in the boiler so that the temperature remains constant. Large temperature variations cannot be tolerated.

2. Area of heating surfaces is reduced considerably by utilization of the Velox principle. For equal-pressure drop through the steam side the surface reduces to about one-fourth or one-fifth of that needed with burning at atmospheric pressure; hence the amount of expensive high-temperature steel needed is reduced.

3. Because the steam enters the external superheater at a relatively high temperature only a part of the heat released in the pressurized furnace is used for superheating. The gas turbine uses part of the remaining energy and returns it to the combustion chamber in the form of compression energy in the combustion air.

4. By recirculating the gas and reducing the temperature of the fresh



DETAILS OF VELOX SUPERHEATER and reheater designed for producing high-temperature steam for a 25,000-kw reheat turbine. Note use of two gas turbines, one for supercharging and the other for recirculating flue gas in unit

combustion gas, and by making best use of the exhaust heat, thermal efficiencies on the order of 90% and over may be attained.

5. Forced circulation of combustion gas makes it possible to operate with large pressure drops on the gas side preventing excessive tube temperatures caused by unequal heating. Large pressure drop in the steam also insures more uniform flow distribution, preventing excessive tube temperatures from unequal cooling.

6. Placing the separate superheater near the turbine keeps high-pressure high-temperature piping very short.

7. Separate firing of the external superheater enables slowly increasing the steam temperature and avoiding difficulties during starting periods.

8. To correct trouble with the external superheater the turbine may be operated with steam directly from the boiler at a reduced load.

CYCLE ARRANGEMENT

Steam leaves the boiler, shown in the cycle on the preceding page, at 2135 psia and 842 F and enters the Velox superheater. It leaves here at 1121 F and enters the first casing of the 4-casing turbine at 1990 psia and 1112 F. From the exhaust of this casing it enters the reheater at 483 psia and 752 F. Leaving the reheater at 441 psia and 1121 F. steam enters the second high-pressure casing of the turbine (behind the first casing) at 426 psia and 1112 F. From there steam successively enters the intermediate pressure casing at 64 psia, 662 F; then the low-pressure casing at 21 psia, 392 F, finally exhausting to the condenser at 1.15 in. Hg abs. Steam moisture at exhaust is 9.38%, well below the limit where erosion troubles start.

Turbine Design. The first high-pressure cylinder, of single-flow design, turns at 9000 rpm. Placed side by side with this cylinder is the second high-pressure cylinder of double-flow construction, so blade length is the same as in the first cylinder. These two cylinders both operate at 9000 rpm and mesh to a common reducing gear. This arrangement enables keeping cylinder dimensions, wall thicknesses and blade lengths to a minimum.

Reducing gear is coupled to the intermediate-pressure and low-pressure rotors in tandem, which run at 3000 rpm. Capacity of 50,000 kw was chosen for this trial design because small units are easy to build. This study has shown that constructing such a unit with prewar high-temperature steels and existing construction practices is feasible.

An objection, often raised against using high-temperature steam, is the possibility of decomposition of steam into hydrogen and oxygen and the danger of corrosion of superheater tubes by nascent oxygen. This does not take place at the temperature proposed because, in spite of the high heat transfer in the Velox superheater, internal temperature of the tube wall, and hence the boundary layer, is only about 120 F higher than steam temperature. In other words, tube temperature is only about 1200 F while decomposition of steam begins at about 2200 F.

On the other hand, the chemical reaction $3Fe + 4H_2O = Fe_3O_4 + 4H_2$ is a function of temperature. At 925 F cases are known where serious troubles have occurred from this cause. One high-pressure station could not be put into continuous service for a long while after starting up for this reason. By slowly raising the temperature and pressure of the boilers with a corresponding slow increase of output it was attempted to form a permanent oxide coating on the tubes to render the surface material immune. This procedure was successful and no further difficulties were experienced.

Chromium Steels. For creep strength, it is important that the steels in the separate superheater have a high chromium content. This makes them highly resistant to corrosion, since chromium favors the formation of a protective coating consisting of double

oxide of chromium and iron. Tests made by Hatfield in England show that a steel of this type used for 1300 F has 37 times greater resistance to corrosion than a tube of ordinary steel. According to Hatfield the time required to reduce the thickness of the walls of chromium-nickel-tungsten tubes by 1 mm would be about 22 years. By rendering the internal surface immune this corrosion could be further reduced to a fraction, if not eliminated entirely.

There is little to fear from intercrystalline corrosion with a large chromium and small carbon content.

Details of a separate superheater designed for a 25,000-kw plant are shown in adjacent drawing. This layout uses an air heater to utilize the energy in the gas leaving the gas turbine exhaust.

STATION PERFORMANCE

With the practical form of a high-temperature steam station outlined, the item of concurrent importance is the over-all station thermal performance. Basis and results of detailed calculations of thermal efficiency and heat rate are given in the adjacent tabulation. Note that these figures are purely theoretical although based largely on practical experience with necessary extrapolations into the high-temperature region.

The turbine and feed-heating cycle can produce energy at a thermal efficiency of 43.3%. Depending on the type of steam-generating equipment applied the over all station heat rate will be between 9300 and 9800 Btu per kwhr.

PREDICTED PERFORMANCE OF HIGH-PRESSURE HIGH-TEMPERATURE STEAM TURBINE STATION

Turbine rated capacity, kw	50,000
Turbine-generator load, kw	40,000
Throttle steam conditions:	
Pressure, psia	1,991
Temperature, F	1,112
Steam conditions entering reheater:	
Pressure, psia	498
Temperature, F	759
Steam conditions leaving reheater:	
Pressure, psia	420
Temperature, F	1,112
Condenser cooling-water temperature, F	59
Condenser backpressure, in. Hg abs	1.14
Total heat drop through turbine, Btu per lb steam	1,756
Turbine arrangement, number of cylinders	4
Turbine rotor speeds, rpm:	
H-p cylinders, I and II	9,000
Medium and l-p cylinders	3,000
Heat rate referred to coupling, Btu per kwhr	7,885
Number of feedwater heating stages	5
Feedwater temperature leaving last heater, F	424
Turbine cycle thermal efficiency referred to coupling output, %	43.3

TYPE OF BOILER AND REHEATER	*Standard*	*Velox*
Feedwater temperature leaving last heater, F	424	212
Unit steam rate referred to generator output, lb per kwhr	6.13	5.40
Turbine-cycle thermal efficiency referred to generator output, %	42.2	40.5
Auxiliary consumption, losses between boiler and turbine, %	3.5	2.7
Thermal efficiency of turbine cycle adjusted for auxiliary consumption and losses %	40.7	39.4
Over-all efficiency of boiler and reheater, %	86	93
Over-all station thermal efficiency, %	35.0	36.6
Station net heat rate, Btu per kwhr	9,750	9,330

First Gas Turbine Goes to Sea

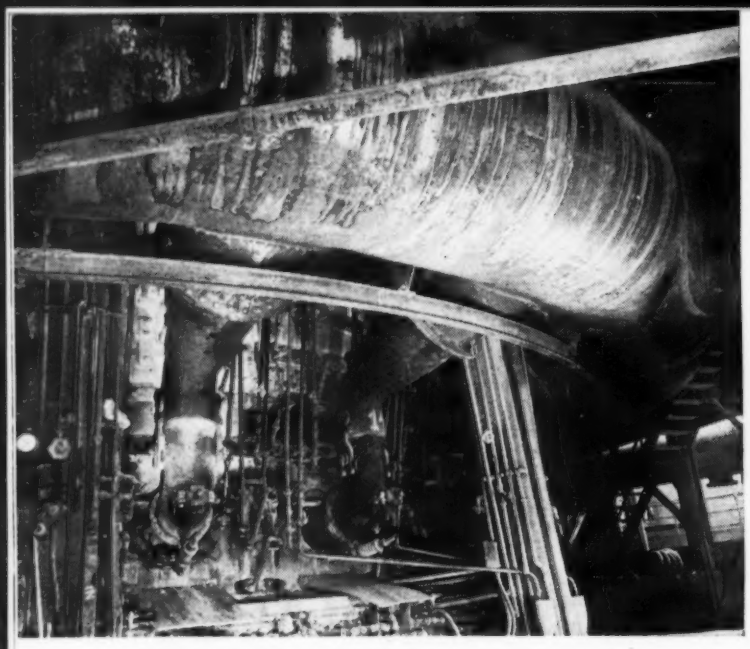
ACCORDING TO an announcement in the September 1947 issue of *The Oil Engine and Gas Turbine*, the first boat to be propelled at sea by a gas turbine belonged to the British Navy. This initial working voyage of the newest-type prime mover took place during August 1947, aboard the motor gun boat 2009. No data are given on inlet-gas temperatures and pressures of this seagoing unit.

The experimental plant was designed and built by Metropolitan-Vickers Electrical Co. Ltd and rated at 2500 hp. Two gas turbines, one axial-flow compressor and a single combustion chamber comprise the principal equipment of the plant. One 2-stage turbine and the 9-stage compressor make up the gas generator unit, while the other 4-stage 2500-hp turbine drives the propeller shaft through a reduction gear, not being mechanically connected to the gas generator unit.

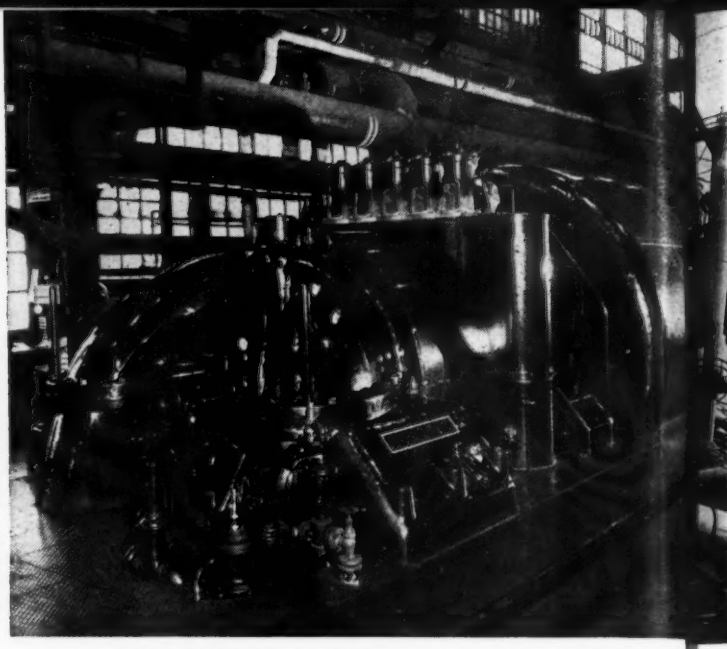
Two ball bearings carry the rotor of the gas generator unit with the turbine disk overhung. Outboard bearing of the compressor also acts as the thrust bearing. Bearings are cooled by air bled from the fifth compressor stage and led through the rotor interior to ventilating passages formed in both rotating and stationary bearing housings. Accessories are driven from the outboard end of the compressor shaft.

The 2-stage turbine has a disk of molybdenum-vanadium steel carrying blading of Nimonic-80 alloy. Air from the compressor outlet flows radially from the disk center over both its sides for cooling.

The 4-stage power turbine has both fixed and moving blading of molybdenum-vanadium steel. Moving blades are mounted in axial serrations forming a drum made of the same alloy, while fixed blades are dovetailed into slots machined in the stator made of forged mild steel. The rotor drum interior is air cooled. On the test floor this unit developed 2550 hp at power turbine speed of 1087 rpm and specific fuel consumption of 1.06 lb oil per bhphr.



AIR FOR BLAST FURNACE enters a large-diameter "bustle" pipe overhead, leading into feeders to the tuyeres



STEAM TURBINE-DRIVEN BLOWER delivers up to 100,000 cu ft of heated air or hot blast per min at about 20 psi

How a Steel Mill Prepares

Blast-furnace gas serves many functions in modern steel mills. W M Cline Jr, combustion engineer, Bethlehem Steel, tells of its preparation as a power source. No. 1 of a 3-part article

► BLAST-FURNACE GAS, a large source of power energy in modern steel mills, requires special handling and preparation to fit it for power service. The quantities formed in the blast furnace and the elements that the gas contains make this a large-scale job.

For instance, an average production figure for a typical 7-blast furnace plant is about 834 million cu ft of gas per day. This quantity is based on an average of 70 cu ft per lb of dry coke charged into the furnace. But this last figure is variable because the gas output is affected by the chemical analysis of the materials in the charge, as well as the quantity of air blown into the furnace.

Blast-Furnace Operation. Let us first find out how a blast furnace functions, to understand better the nature of the gas it produces. Various proportions of iron ores, coke and limestone are fed into the top of the furnace, and variable quantities of heated air forced into the furnace through the tuyeres. In a charge, the quantities of the materials needed to make a ton of iron differ with their metallurgical properties. The ores used contain variable percentages of iron, silica, phosphorus, etc. Iron content of ore influences the amount necessary to produce a ton of iron. Quantities of various remaining elements in the ore, as well as sulphur content of the coke, influence the amount of limestone required. Normally, all phosphorous in the charge appears in the iron, whereas silica and sulphur are distributed between the iron and slag, depending on the slag's ration and volume, furnace temperature, and other variables.

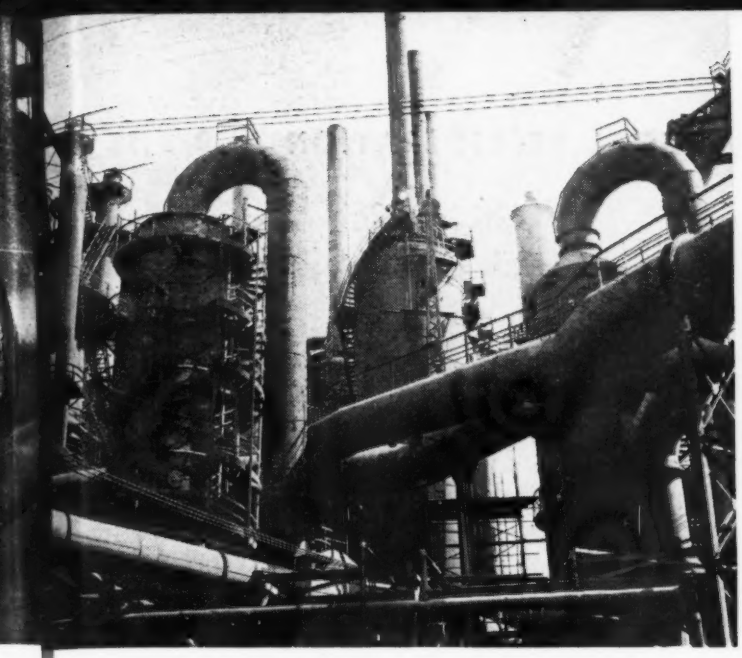
If iron content of the ore runs about 50%, a typical charge is 4000 lb ore, 1600 lb coke, and 900 lb limestone. Air needed is about 7500 to 8000 lb.

This air is heated in stoves, which are brick-lined vertical shells containing checkers, or baffles; it then passes through the hot-blast main to the furnace distributing main, called a "bustle pipe." From this pipe, photo at left, the air is distributed through connecting pipes to tuyeres. These are watercooled copper castings, varying in number. This heated air, under about 20 psi, supplies the oxygen necessary for combustion of coke in the charge. Nitrogen in the heated air passes through the furnace practically without chemical change. Although it serves to preheat the incoming charge, it also carries a large amount of heat out of the furnace.

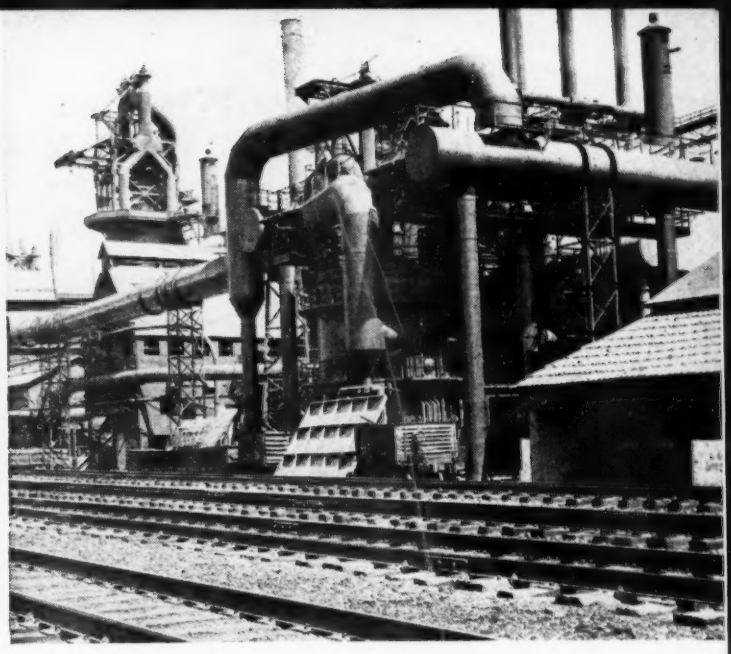
When oxygen in the heated air comes in contact with carbon in the coke, CO_2 is formed which, in the presence of the excess carbon, is reduced to CO. Gaseous products of combustion pass up through the shaft of the furnace, coming in contact with the iron oxides in the ores; the CO reduces the oxide to metallic iron, which melts and sinks to the bottom of the furnace.

Meantime, limestone, descending through the hot gases, is decomposed to form calcium oxide and carbon dioxide. The latter, a gas, reacts with some of the carbon in the coke and is reduced to CO. The calcium oxide combines with the impurities in the iron ore, some unreduced iron oxide, and ash in the coke to form a slag. This becomes fluid and sinks to the furnace bottom where it floats on top of the iron. Part of this slag is drawn off at the "cinder notch" between casts, while the rest follows the iron out of the "iron notch" at the end of each cast.

Control of Output. In general, output in tons of iron for any furnace depends on the chemical analysis of the materials charged and the amount of air that can be forced through the furnace while it still maintains smooth op-



PRIMARY WASHERS (left and right of center) remove by a spray much of the solid content in the furnace gas



FINAL DUST REMOVAL for blast-furnace gas occurs in electrostatic precipitators below piping structure

Blast-Furnace Gas for Fuel

eration. The larger the quantity of air used, the more coke can be burned and the faster the rate of ore reduction. Usually a furnace is burdened for the maximum amount of air that can be blown without producing too high a velocity in the shaft, which would cause excessive pressure drop and irregular descent of stock through the furnace.

This velocity is kept within limits, determined from experience, for the kind of charge in the furnace. In addition to upsetting the operation of the furnace, high gas velocities aggravate the problem of preparing blast-furnace gas for power service because the dust content of gas leaving the furnace is higher at higher velocities. Exit-gas pressure at top of furnace normally runs about 2 psi.

Amounts Involved. Gas issuing from blast furnaces represents a fuel potential that aggregates about 20% of the total fuel required for operating a large, fully integrated steel plant. Of the 834 million cu ft per day mentioned before, 20% goes to hot-blast stoves for preheating the air about to enter the furnaces. The remaining 80% supplies general plant needs, such as metallurgical furnaces, steam boilers and gas engines. At an average calorific value of 92 Btu per cu ft this heat source amounts to nearly 2000 net tons of coal per day.

Chemical analysis of gas leaving the furnace varies because of properties in the charge, but a typical one is:

CO_2—13.0%	CH_4—0.2%
CO —26.0%	H_2—2.6%
N_2—58.2%	

The same variables affecting the chemical analysis influence the calorific value so it may range from 80 to 105 Btu per cu ft.

This gas carries a high dust content, anywhere from 4 to 20 grains per standard cu ft. This high dust content renders raw gas unfit for direct use.

Accordingly, gas leaves the furnace through a downcomer to a cyclone dust catcher, for the first reduction in entrained solids. From here it enters primary washers, photo above, where, in passing through sprays of water a large percentage of solids is removed. Gas leaving this stage has a dust content from 0.1 to 0.3 grains per cu ft. Some boilers fire a gas of this quality but for gas engines and underfired coke-oven service, or as a mix with coke-oven gas for mill use, the solids content should be down around 0.01 to 0.005 grains per cu ft.

Usual practice takes blast-furnace gas, after it leaves the primary washers, through the electrostatic precipitators, photo at right, to get solid content down to the above range.

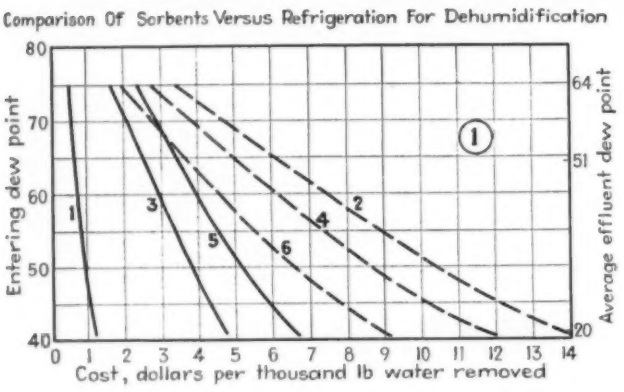
Gas Storage. Now that the gas is free enough of entrained solids let's see how it shapes up as a fuel source. Its low calorific value makes large volumes necessary for any heating operation. In addition, it has suffered a pressure loss on its way through the various cleaning equipment. Distributing pipelines, to transport the required volumes of low-pressure gas, are generally quite large —five to seven feet in diameter.

Storage tanks, or holders, large enough to supply such mains any length of time are so costly that their use is not general. Sometimes small holders serve as a supply base for secondary-cleaned blast-furnace gas to insure safety margin for gas-engine operation.

Gas Distribution. The very fact that blast-furnace gas constitutes a by-product of a plant furnace makes the supply a fluctuating one. Most steel plants employ 2-fuel steam boilers, which help free plant power services from the effects of a fluctuating blast-furnace gas supply. Generally these boilers fire either blast-furnace gas or coal. Gas is in maximum use when there is an excess, and coal when there is a shortage of gas.

The typical steel plant has a list of preferred "customers" for blast-furnace gas. As long as it is available, they can have gas. Included are users of gas engines and coke ovens, a general group, whose reheating furnaces require either straight blast-furnace gas or mixed blast furnace and coke-oven gas, and a so-called "flywheel group." This group is usually the boilerhouses throughout a plant that serve to even out the peaks in supply and demand.

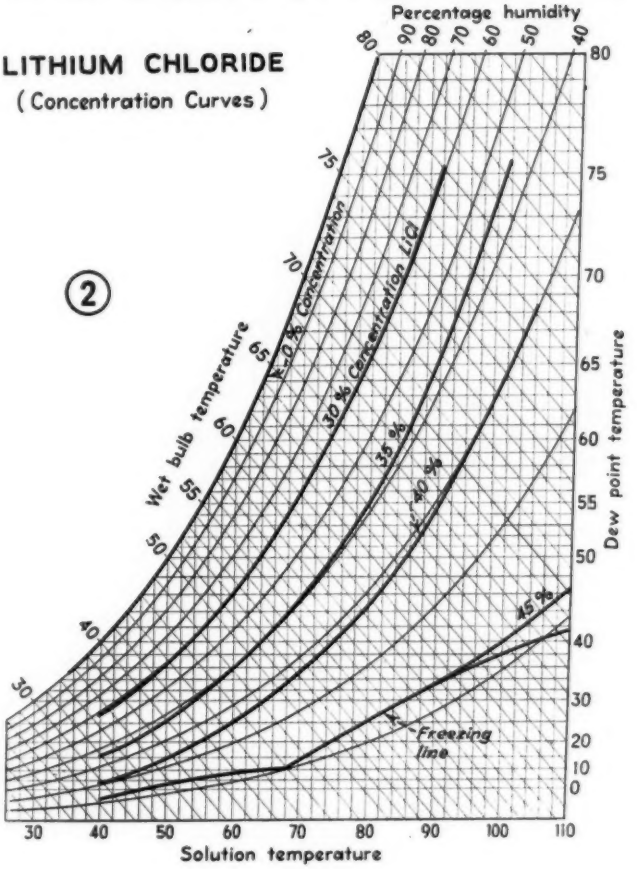
COMPARISON BETWEEN MECHANICAL REFRIGERATION AND THE LITHIUM CHLORIDE



KEY TO CHART NUMBERS

1 Sorbent with 135-F effluent air
2 Refrigeration with 135-F effluent air
3 Sorbent with 95-F effluent air
4 Refrigeration with 135-F effluent air
5 Sorbent with 70-F effluent air
6 Refrigeration with 70-F effluent air

CONDITIONS FOR CHART, ABOVE: Entering dry-bulb, 95 F. Refrigeration, electrically operated. Sorbent, reactivated by steam. Electricity, 1c per kwhr. Steam, 30c per 1000 lb.



Sorbents Regulate Humidity by Soaking

By JOHN EVERETTS Jr, *Urdahl & Everetts*

Either of these methods can regulate within close limits the relative humidity, important factor that must be considered wherever normal atmospheric conditions interfere with human comfort, manufacturing processes or the storage of materials

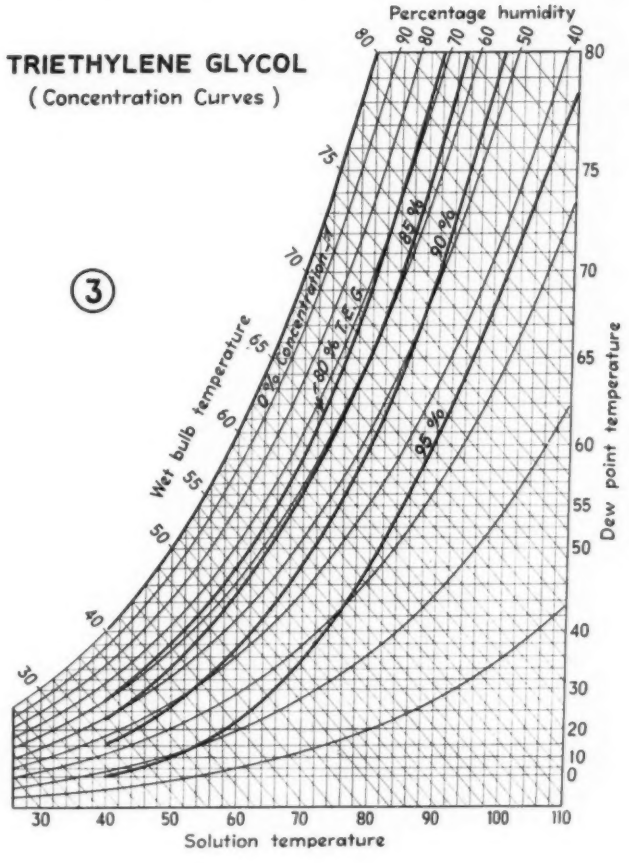
► DEHUMIDIFICATION IS the process of removing moisture from the atmosphere or other gas. It is required in: (1) storage of foods, manufactured parts and other materials to prevent corrosion, mold, mildew and rot (2) drying processes (3) air conditioning (4) packaging to prevent moisture damage during shipment.

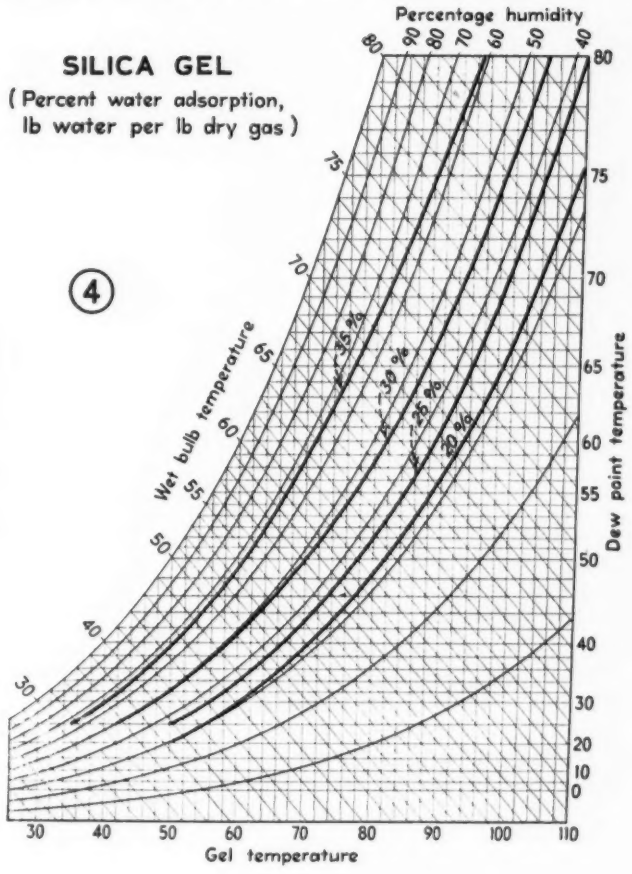
Although dehumidification has been in use many years, it came into prominence during World War II through the location of war plants in humid areas; shipment overseas of vast quantities of foods and materials; preservation of Naval ships, Army and Navy ordnance equipment; and storage of materiel at the end of the war. Development of sorbent materials and dehumidifying equipment for wartime use has advanced so far in operation and efficiency that it is now practical and economical for commercial applications.

Effects of Moisture. Damage from moisture in storage of materials runs into millions of dollars each year, and is accepted as an operating loss and written off the books as such. The Navy Bureau of Ships made extensive experiments with all kinds of materials under various levels of relative humidity. Metals rust and tarnish in atmosphere whenever the relative humidity exceeds 25%. Mold and mildew start at relative humidities over 70% with temperatures as low as 80 F. There are a few exceptions where even a lower condition of temperature and relative humidity causes damage. Radio and other electrical equipment deteriorates and hygroscopic materials, such as foods and chemicals, spoil and become useless at relative humidities as low as 50% depending on the material and its moisture-regaining characteristics.

Advantages. Proper application of dehumidification and experience gained in the last war prove that this loss may be converted into a profit at small cost. The Navy Bureau of Yards and Docks humidified one of its large warehouses and reported that "the operating cost for dehumidification is 1/20th of 1% of the value of the material handled, and the investment cost was 3% of the

VARIOUS SORBENTS USED TO REMOVE MOISTURE FROM AIR





Up the Moisture in Air

Psychrometric charts courtesy of The Trane Company. Curves were plotted by the author.

value of the material stored." A major airline found for a cost of less than $2000, which included vaporproofing the storeroom, it could save over $7000 a year on replacement of radio parts and repair by installing dehumidification equipment. These are just two examples where moisture removal has really paid dividends.

Moisture can be removed from the atmosphere by (1) refrigeration or (2) passing air through a sorbent material. Refrigeration method cools the air to the desired dewpoint, and then reheats it to the temperature necessary to maintain the required relative humidity. This method is more costly and less efficient than the sorbent process, especially if the required dewpoint is below 65 F and relative humidity below 50%.

Refrigeration Method. Complete system employs a refrigerating compressor, cooling coil to reduce air temperature to the dewpoint, and a reheat coil, either hot refrigerant-gas type, or steam coil, to raise the air temperature and maintain desired humidity. As the required dewpoint becomes lower suction temperature of the refrigerant must be lowered, thus reducing the compressor capacity. At the same time the reheat temperature has to be raised. If refrigerant gas is used this increases the condensing pressure, which requires a greater power input to the compressor. This accumulative inefficiency makes the method more expensive in over-all operating cost, Fig. 1. Where dewpoint temperatures below 32 F are required, there is the additional difficulty of frosted coils and the attendant problem of defrosting.

Sorbent Method. Because the problem of dehumidification is primarily removal of water vapor, the sorbent method is the obvious answer. A sorbent, either liquid or solid, is a material that has the ability to condense water vapor without affecting the characteristics of either the material or the air. A sorbent, to be commercially practicable, must be: (1) chemically and physically stable (2) inert (3) noncorrosive (4) commercially available at low cost

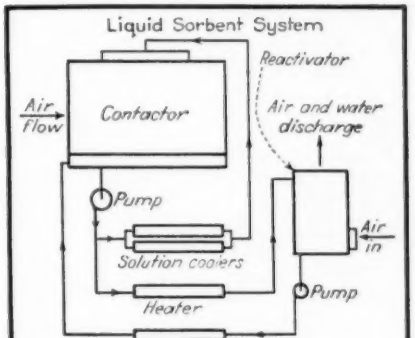


Fig. 5—Liquid sorbents, sprayed into air stream, can humidify or dehumidify

(5) readily reactivated at low cost (6) mechanically stable—no carry-over in air stream (7) unaffected by inclusion of airborne dust and dirt.

Liquid Sorbents. These are halogen salts and glycols. Halogen salts comprise chiefly lithium chloride, Fig. 2, calcium chloride, and combinations of lithium, calcium, and sodium chlorides and bromides. Glycols consist chiefly of ethylene, diethylene and triethylene glycol, Fig. 3, used in varying degrees depending on conditions to be main-

TYPICAL DESIGN OF MECHANICAL EQUIPMENT USED FOR APPLYING

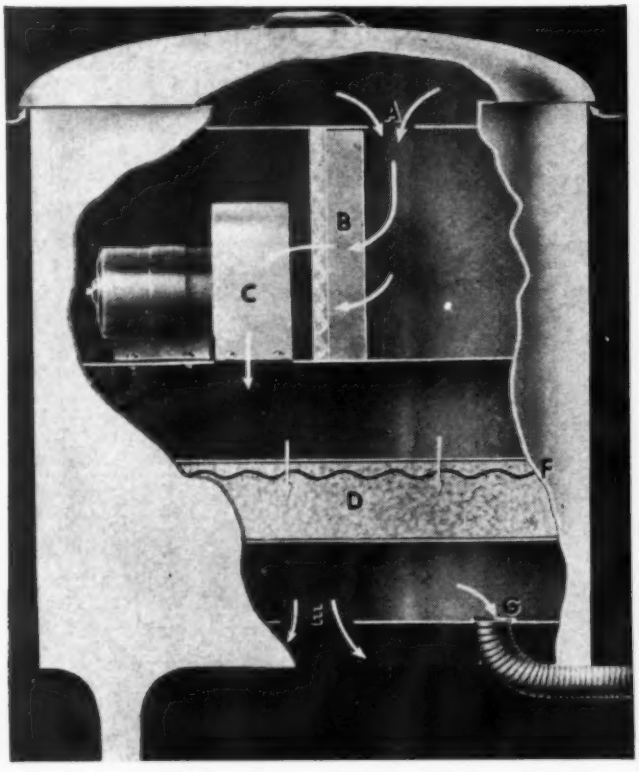


Fig. 6—In a single-bed unit, the inlet air at A passes through filter B to blower C, then through sorbent bed D

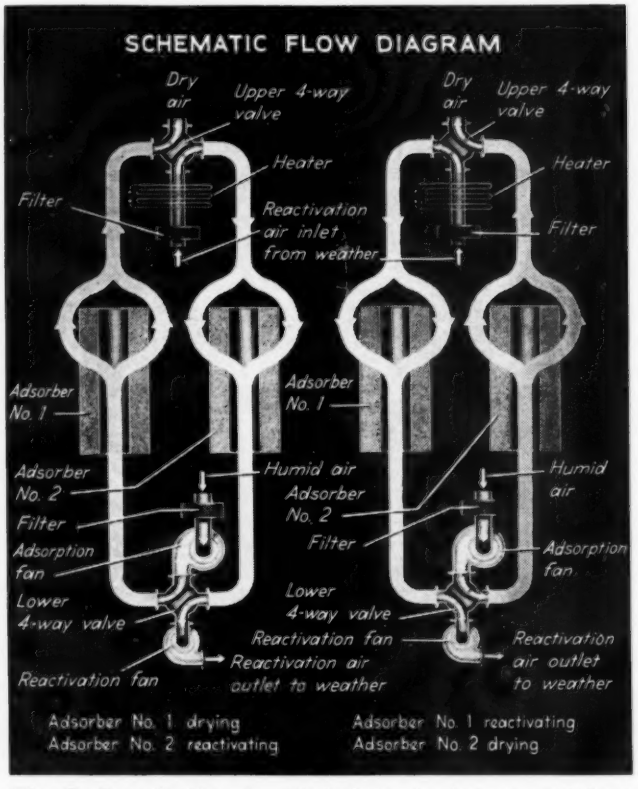


Fig. 7—Reactivation is effected by heated air obtained through a separate fan or as part of the main air stream

tained in the air-conditioned space.

As a liquid sorbent depends primarily on its density for moisture removal, density control must be exacting or the solution may become very viscous and require additional pumping facilities; or it may freeze in the circulating system, making maintenance of piping and pumping equipment costly. Changes in density and temperature may also throw the solution into another phase condition, which materially changes its characteristics. This characteristic of the halogen group is not so true of glycols. They are much less corrosive but, because they have to be operated at a higher density, are more difficult to control. Glycols also have a higher vapor pressure, Fig. 3, which results in greater carry-over loss.

A liquid sorbent has an advantage over a solid sorbent because it is able to humidify as well as dehumidify without humidifying equipment. The former also maintains a constantly delivered air condition which, in certain processing work, may be desirable.

Equipment Needed. A liquid-sorbent system requires a main contact tower, reactivation or concentrator tower, solution coolers, solution heater, circulating pumps, and necessary density and temperature controls. Air to be treated passes through the contact tower where water vapor is absorbed. Latent heat of the vapor plus the chemical heat of absorption is picked up by the solution and its temperature raised proportionally. The warm, weak solution is withdrawn from the contact-tower sump; part is pumped through coolers, and part is diverted through a solution heater, and then to the reactivation tower, Fig. 5.

The weak solution is heated to a temperature corresponding to a vapor pressure well over that of the air blown through the reactivator so water in the solution may be picked up by this air and carried out to atmosphere. The concentrated solution is then pumped through a cooler and discharged back into the main solution stream to maintain the proper density. Density control may vary either the amount of solution flowing to the concentrator or the temperature to which the solution is heated to govern the amount of water removed. There are, of course, many other control methods.

Solution cooling may be done with cooling-tower water, well water, or any other medium available at low cost. The solution may be heated with low-pressure steam, gas, oil, or waste heat. Instead of heating the solution directly, the air to the reactivator may be heated. This, however, requires a larger reactivator and a greater quantity of air. An inhibitor control should also be provided to maintain the solution pH above 4.0 to minimize corrosion. Filters for both solution and air are needed to prevent sludge and dirt accumulating in the system. Efficient eliminators should also be provided on the discharge side of both the main contactor and the reactivator to reduce solution carry-over to a minimum.

Solid Sorbents. These materials depend upon temperature for adsorption efficiency. The lower the temperature, the greater the efficiency. As they undergo no phase change (except solid calcium chloride which is an absorbent) there is no limit to the range of conditions that may be maintained, Fig. 4.

In a joint research program during the war the Army and Navy studied approximately 20 different solid adsorbents for sorption efficiency, chemical and physical stability, reactivation efficiencies, and other characteristics. Those studied include various grades of silica-gel, activated alumina, activated clays and various sulphates. Results of the tests indicate that silica-gel and activated alumina have the highest adsorption rate, are most stable, and are

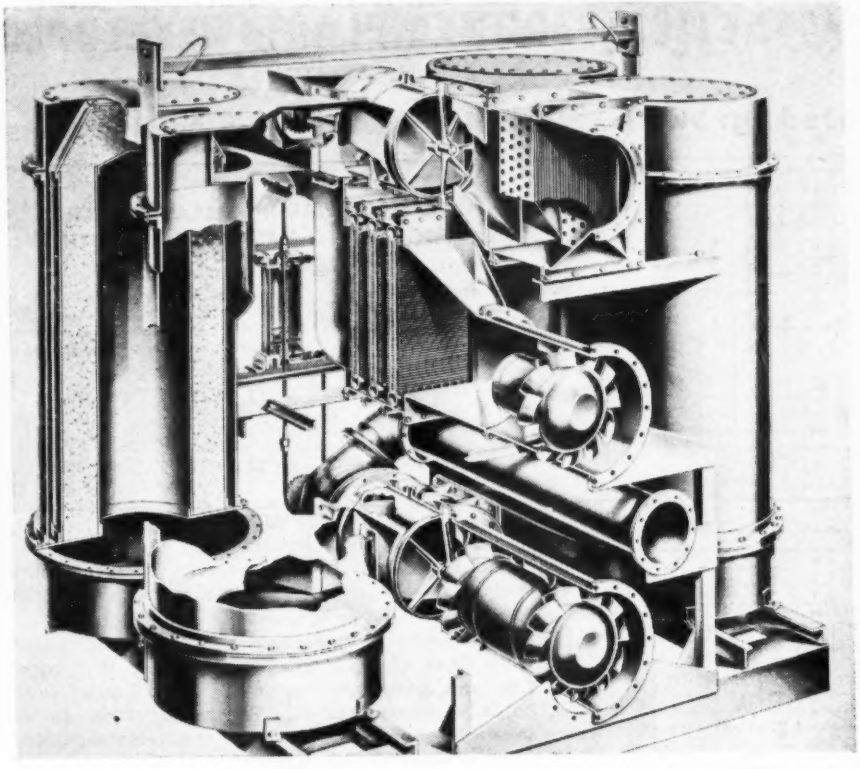


Fig. 8—Dual-bed units maintain a continuous flow of the dehumidified air by running one bed on the adsorption cycle while the other is being reactivated

efficient to reactivate. Equipment, which was developed and manufactured using these two sorbents, is successfully employed in thousands of installations on board ships, in warehouses, process work, and many other applications where moisture is a problem.

Type of Machines. Equipment for solid sorbents is designed in either single- or dual-bed machines. The single-bed unit consists of a housing, fan and filter assembly, sorbent bed, automatically operated valve mechanism, and humidity control. The machine operates on the adsorption cycle for a set period depending on the conditions to be maintained, and then automatically changes over to the reactivation cycle. At the end of reactivation, which is set by a clock mechanism, the unit again changes over to adsorption.

During reactivation no adsorption takes place. For a small installation or for reasonably tight warehouses, however, this is not objectionable as the build-up of humidity during this time is small and will be leveled off as soon as the machine takes over on the adsorption cycle again. The small single-bed units are adaptable to tool, die-storage, food storage and pump rooms, radio transmitting and receiving stations, telephone exchanges, and hundreds of other applications, Fig. 6.

The dual-bed machine, Fig. 8, maintains a continuous flow of dehumidified air. There are two beds of sorbent material of equal capacity; while one is adsorbing, the other is under reactivation. After a designated period, determined either by temperature, humidity, or time control, the dried bed is automatically changed over through a set of 4-way valves to the adsorption cycle. At the same time the wet bed is placed on reactivation. Bed drying is accomplished by heating the reactivation air (obtained through a separate fan or as part of the main air stream diverted for this purpose, Fig. 7) by direct-fired gas, steam or oil.

Dehumidification equipment is designed primarily for water removal; therefore capacities are expressed in terms of lb of water removed per hr rather than in terms of cu ft of air handled. Reason is that a small amount of air can be dehumidified to a low dewpoint, and then mixed with untreated air if necessary to maintain a desired air volume. If total air volume is passed through the equipment, it requires sorbent beds of much larger capacity and the over-all system efficiency is reduced because full advantage of the sorbent cannot be obtained.

A solid sorbent in a *dynamic* or mechanical unit operating in the most efficient range adsorbs from 10 to 20% of its weight in water vapor. To go beyond this range reduces the adsorption-cycle efficiency because of the lower rate of adsorption as the bed becomes saturated, and on the reactivation cycle because of the longer time and greater heat required. Amount of heat needed for reactivation depends upon water-removal rate and the entering air's moisture content.

Static Units. Use of solid sorbents in *static* dehumidification has found great favor in packaging materials and for dehumidifying small closets, instrument cabinets, gun cases, food compartments in kitchen cabinets, and sundry other places where moisture is detrimental.

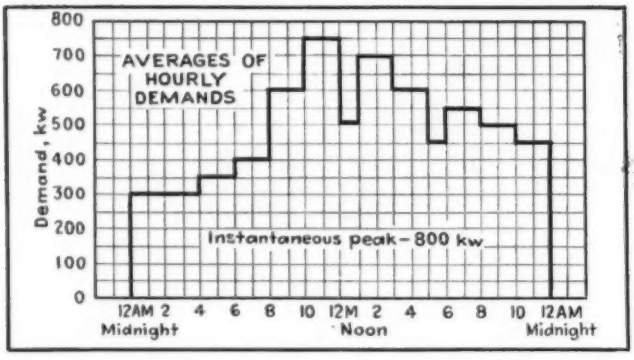
One wartime device, used by the Army and Navy, is now available commercially in several sizes. It is an aluminum container, filled with silica-gel and containing an indicator eye to show the condition of the gel. When ready for use, the eye is bright blue; after the gel has adsorbed all the moisture it can hold under the conditions the color changes to pink. When the eye is pink, the can may be placed in an oven at about 300 F for 2 to 3 hr and reactivated for reuse. No replacement of gel is required and the can may be reactivated indefinitely. Adsorption rate for *static* dehumidification varies from 20 to 40% of water vapor to weight of gel, depending on the conditions of temperature and humidity.

Dehumidification for process has been successfully accomplished in many applications. Food and chemical processes, blast-furnace drying, and many other processes have found this method both economical and productive in quality control of the product. Sorbents play an important part in air conditioning and comfort cooling work. A sorbent-type dehumidifier may handle the entire latent heat load, thus leaving the refrigeration system to handle only the sensible heat. Or in an existing air-conditioning installation, a dehumidifier may increase system capacity by the amount of the latent-heat load. Advantages of such a combination are: (1) Under partial load no re-heat is required. (2) Over-cooling and over-humidifying is prevented. (3) The system can be operated more economically.

With the development of new sorbents and their more efficient use, dehumidification will play an important part in reducing losses created by moisture—loss can be converted into profit.

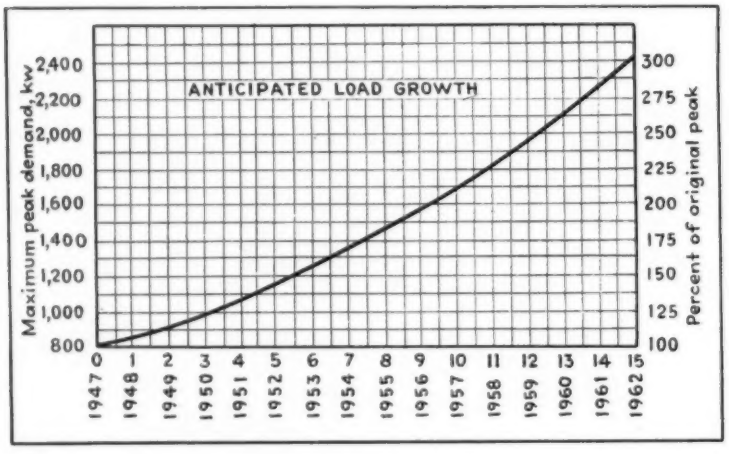
ANALYSIS OF A HYPOTHETICAL DIESEL-PLANT DEVELOPMENT

This load and anticipated growth . . . would be met by these units . . .



COMPARISON OF INITIAL INSTALLATIONS AND FUTURE ADDITIONS TO MEET LOAD GROWTH

Nonsupercharged Engines			Supercharged Engines		
Year	Capacity each unit, kw	Firm capacity of plant, one standby, kw	Year	Capacity each unit, kw	Firm capacity of plant, one standby, kw
1	600		1	1000	
1	600		1	1000	1000
1	400	1000			
4	1400	1600	4	1000	2000
10	1400	3000	13	1000	3000



Curves at left show existing and expected future loads, to be met by diesel-electric power plants compared here as to performance and investment

Use of supercharged engines permits installation of engines of equal size, gives better firm capacity and good fuel economy as compared with nonsupercharged units. The table above shows schedule of initial and future engine installations

Flatter fuel-rate curve of supercharged engine results in better performance over load range, as shown in chart and summary table at the right

Plant with supercharged engines has lower investment cost for initial installation and savings over nonsupercharged-plant increase as later additions are made. Table at far right gives data

Value of Supercharged Diesels Shown

Better fuel consumption and lower investment cost result from choice of supercharged diesels to meet existing and future load. Volney M Holmes, Worthington Pump & Machinery, tells why

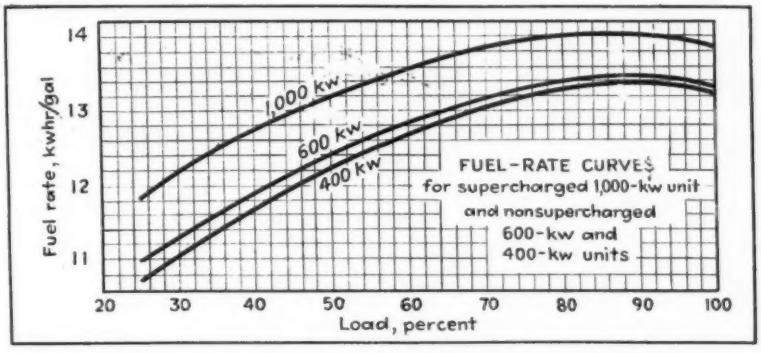
▶ DIESEL ENGINES have always stood in the forefront of prime movers for thermal efficiency, but their 50-year history has also seen constant improvement in mechanical design and general efficiency as well as increased specific output. One of the most important steps in the engineering evolution of the diesel is the application of supercharging to 4-cycle engines. Thus first cost is reduced, space requirements are cut and performance is improved. Engines of this type attract more and more attention from engineers and users faced with the need for reliable low-cost power.

High Fuel Economies. The value of supercharging to cut the cost of diesel-power generation can be gaged best by actual results, and by performance and cost comparisons with nonsupercharged engines. Consider, for example, the experience at one of the first heavy-duty all-American-built stationary installations. This plant, containing three 500-kw supercharged diesel-electric units, generated 14,142,900 kwhr during the first 34 months of operation. One of these units, with a running-engine-capacity factor of 67.4%, produced 14.25 kwhr per gal of fuel oil during the period, which is equivalent to 0.358 lb per bhphr, based on oil at 19,350 Btu per lb. Curves at the right show fuel rate of this 500-kw unit compared with an engine of the same bore, stroke and speed but not supercharged. These curves are based on actual fuel consumptions and show better performance than would guarantee curves, which are more conservative.

Using the actual kwhr generation of this supercharged unit as a base, let's see what savings resulted, in comparison with a nonsupercharged engine. At the rates shown by the curves for 67.4% load, 13.1 and 14.25 kwhr per gal, respectively, the nonsupercharged unit would consume 1,079,600 gal in contrast to the 992,400 gal of the supercharged unit. Thus, in generating 14,142,900 kwhr, the supercharged engine saved 87,200 gal, or 10 tank cars.

ENT COMPARES NONSUPERCHARGED AND SUPERCHARGED ENGINES

. . . with these fuel and lube-oil consumptions . . . and these investment costs



COMPARISON OF FUEL AND LUBRICATING-OIL CONSUMPTIONS FOR FIRST YEAR OF OPERATION, BASED ON AVERAGE LOAD

Hr per day	Rating of engines, kw	Average load, kw	Load factor, %	Fuel rate, kwhr per gal	Total output, kwhr	Total fuel oil, gal
			Nonsupercharged Engines			
6	1 — 400	316	79.0	13.25	693,500	52,300
2	1 — 600	400	66.6	12.95	292,000	22,400
9	1 — 400 / 1 — 600	645	64.5	12.95	2,117,000	163,100
7	1 — 600	493	82.0	13.40	1,259,250	93,700
Total					4,361,750	331,500
Engine-running-capacity factor.....71%				Average fuel rate.....13.18 kwhr per gal		
			Supercharged Engines			
6	1 — 1000	316	31.6	12.30	693,500	56,300
2	1 — 1000	400	40.0	12.75	292,000	22,850
9	1 — 1000	645	64.5	13.70	2,117,100	154,100
7	1 — 1000	493	49.3	13.15	1,259,250	95,400
Total					4,361,750	328,650
Engine-running-capacity factor.....49.8%				Average fuel rate.....13.25 kwhr per gal		

Lube-oil consumption: nonsupercharged engines, 2040 gal; supercharged, 2190

INVESTMENT COSTS COMPARED

	Nonsupercharged	*Supercharged*
Number and capacity of units installed	2 — 600 kw 1 — 400 kw	2 — 1000 kw
Total capacity installed	1600 kw	2000 kw
Price, fob works*	$179,000	$203,000
Approx shipping weight, lb	346,000	336,000
Freight at $1.25 per cwt	$4,300	$4,200
Cartage, etc, $20 per ton	$3,460	$3,360
Station piping	$6,800	$7,900
Storage tanks — 2 of 20,000-gal capacity each	$2,000	$2,000
Unloading pump	$500	$500
Foundations, $30 per cu yd	$7,500	$6,000
Erection superintendent	$4,300	$4,200
Labor	$10,500	$10,000
Generator panels**	$11,300	$7,900
Total installed cost	$225,360	$249,060
Installed cost per kw	$140.50	$124.53
Bldg for final installation		
Dimensions, ft	90x35x24	70x35x20
Volume, cu ft	118,800	77,000
Bldg cost, $0.80 per cu ft	$95,040	$61,600
Total plant cost	$320,400	$310,660
Initial investment per kw	$201.10	$155.33
Investment at End of Fourth Year		
Cost of additional unit	$176,030	$124,530
Total cost to date	$496,430	$435,190
Cost per kw	$165.47	$145.39
Investment at Plant Completion		
Cost of additional unit	$176,030	$124,530
Total cost to date	$672,460	$559,720
Cost per kw installed	$152.80	$139.70
Cost per kw of firm capacity	$224.15	$186.57

* Includes engines, generators, exciters, fuel-service tanks, fuel-transfer pumps, pyrometers, circulating-water pumps, evaporative coolers, starting-air tanks and starting-air compressors.

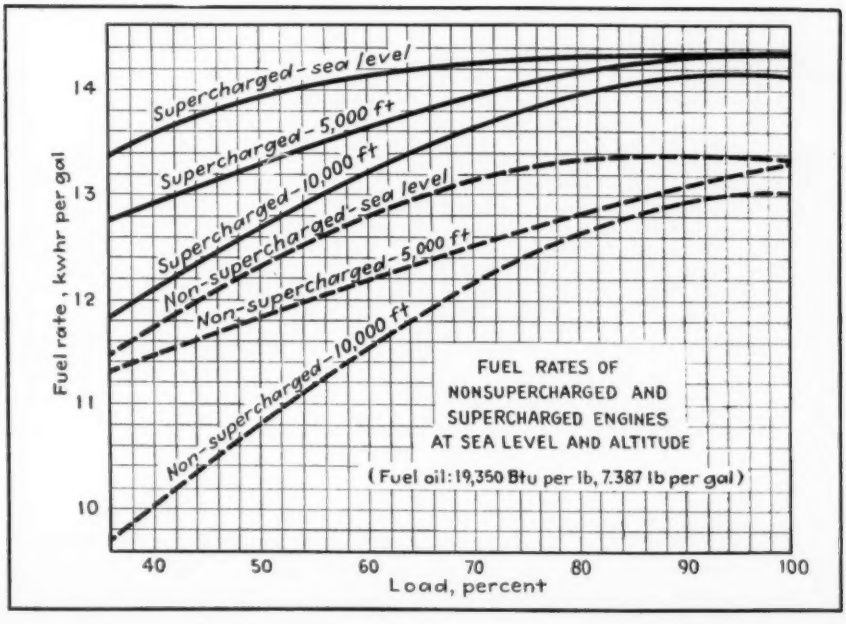
** Includes voltage regulator, watthour meter, indicating wattmeter, necessary switches, instruments and swinging bracket for each panel.

By Performance and Cost Comparisons

If the engines were to operate at 55% load factor, which is commoner, the saving would be even greater. At this lower load factor, the nonsupercharged engine turns out 12.6 kwhr per gal, while the supercharged unit does 14.05. For the 14,142,900 kwhr taken as our base, total fuel consumptions are 1,122,400 and 1,006,600 gal, for a saving in favor of the supercharged engine of 115,800 gal, or about 14 carloads.

These figures are based on sea-level operation. When consumptions are corrected for operation at 5000 and 10,000 ft above sea level, the results are as shown by the other sets of curves. Examination discloses that even at an altitude of 10,000 ft, the supercharged engine produces more kwhr per gal of fuel than the nonsupercharged engine at sea level.

Thus the fuel savings resulting from



supercharging are still more impressive for altitude than for sea-level operation. Using the same total generation as before—14,142,900 kwhr—and 55% load factor, the savings become 164,700 gal at 5000 ft and 170,600 at 10,000 ft. This amounts to 20 and 21 carloads respectively.

Utility Plants Compared. These examples demonstrate high fuel economies over a wide range of varying loads from below half to full-load guarantee points. We shall now see how other advantages accrue from use of supercharged engines. The best example is derived from comparison of two utility plants generating power for a municipality—one equipped with nonsupercharged engines and the other with supercharged. Curves and tables in the panel on the preceding page summarize results of the comparison.

Load conditions for both plants are indicated by the daily-load curve and one showing anticipated load growth. Seasonal variations are not taken into account as they do not make much difference one way or another here. The advantages of supercharged engines appear as soon as we begin to select engine sizes to meet these loads.

In selecting engines for a multiple-unit station operating 24 hr per day it has been the practice of engineers to "step" the sizes to best match periods of load variation. Usually, sizes are chosen so at least one small engine will carry the low night load. This is advantageous in maintaining a reasonably high running-engine-capacity factor. Even though the nonsupercharged diesel has a flat fuel-consumption curve compared with other prime movers, it starts changing rapidly at about half load, and size selection must take this into account.

With supercharged diesels having an even flatter fuel-rate curve the problem of unit-size selection is simplified. Choice can be made for better operating economy with provision for greater load growth. In addition, the initial and final cost per kw installed will run lower than for nonsuperharged engines. Future additions can be kept to sizes of initial units while still maintaining firm-capacity factors equal to or better than similar nonsupercharged "stepped rating" plants that must revert to addition of units much larger than those originally installed. And, too, the ultimate total installed horsepower for a given firm capacity can be held below that required in plants that use nonsupercharged engines.

These points are illustrated in the tabulation showing initial selections to satisfy the existing load and the additions to take care of load growth. Since the plant is to operate 24 hr per day, installations provide for one standby unit. The firm capacity will then be that available when the largest engine in the plant is down, as shown.

In connection with the nonsupercharged engines it is, as previously explained, accepted practice to select uneven sizes to fit varying loads throughout the day. This is done to maintain a high engine-running-capacity factor and get away from the high fuel consumption when operating at or near 50% load. While this advantage is attractive in the initial stages of establishing a diesel power plant, it does not lend itself to the most economical means of expansion.

By keeping all engines of equal size, better fuel economies can be maintained at 50% for supercharged engines than for nonsupercharged at 70% load, and initial investment is reduced at the same time. Further, plant additions to provide for growing load are less costly when initial units are of equal size and the same sizes are added.

Consumption figures for the engines chosen are shown in the curve on the preceding page. These are based on guarantees and while the values are more conservative (especially for the supercharged engines) than expected in actual practice, they represent relative values that enable making a fair comparison of the two plant types. The table below the fuel-rate curves summarizes fuel and lubricating-oil consumption for the first year of operation, based on average load conditions.

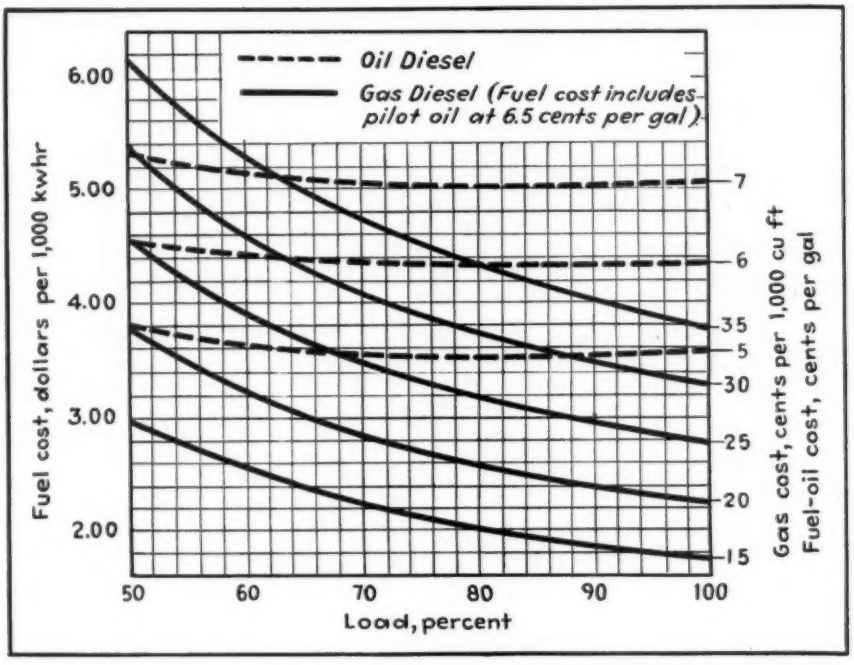
With continued load growth, running-engine-capacity factors will increase. Greater improvement in economy can be expected with the supercharged plant, starting at a low load factor, than with the nonsupercharged starting at a high load factor near its peak performance.

In the table adjacent to these other comparisons are shown the over-all costs and cost per kw of establishing the two plants. This lists first the figures for the initial installations and then the additional costs involved in making the additions specified in the table of unit sizes. It is expected that the 1400-kw unit added to the nonsupercharged plant will—everything being equal—cost 10% less than the initial units, or $126.45 per kw. The additional supercharged unit will come to the same price as the original unit, or $124.53 per kw.

This comparison shows that the saving in investment represented in the initial supercharged plant, $9740, increases to a total of $61,240 after the

(*Continued on page* 160)

FUEL COSTS COMPARED: SUPERCHARGED DIESELS AND SUPERCHARGED GAS DIESELS



Curves above are based on fuel oil and pilot oil of 19,350 Btu per lb, higher heating value, and fuel gas of 1000 Btu per cu ft, also higher heating value

Pulp Plant Revamps Power by Steps

Load growth in the pulp industry makes immediate steps for new steam and power facilities a top operating requirement. Here is how one company is modernizing its equipment without any shutdowns

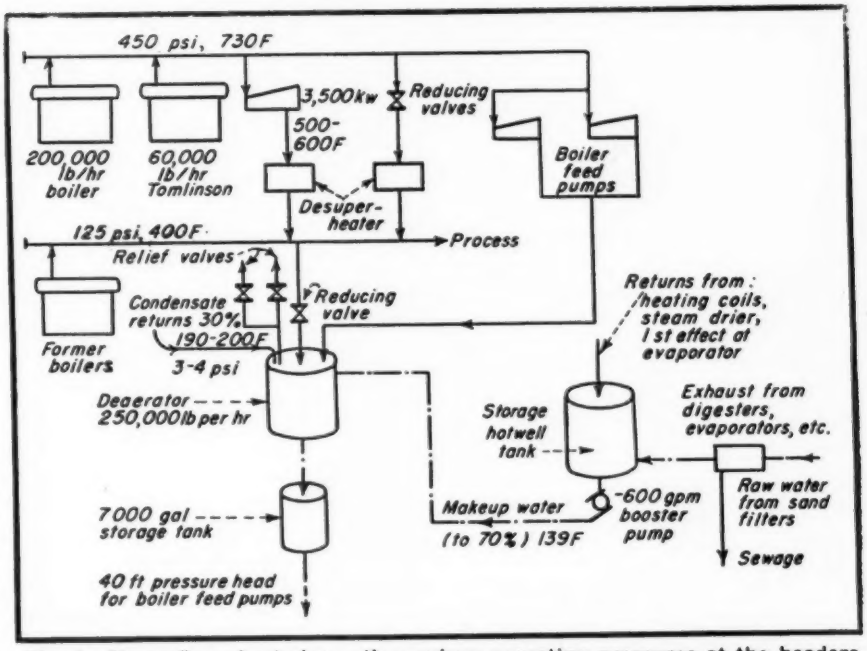


Fig. 1—Steam-flow chart shows the various operating pressures at the headers. Steam from heat-recovery unit and large boiler supplies a new pressure level

► IN THE PULP AND PAPER INDUSTRY today, demand for power services leaves many a plant hard pressed for steam facilities. The Penobscot Chemical Fibre Co in Great Works, Me. is meeting its problem by a heavy modernization program carried on without shutdown.

Most recent installations to fit into the present cycle are: (1) a 200,000-lb-per-hr 450-psi 730-F steam generator, the largest in the state of Maine and (2) a Tomlinson 60,000-lb-per-hr 450-psi saturated-steam heat-recovery unit.

Various process needs throughout the pulp-making plant employ steam directly from the mains. This steam must be of the highest purity because the color of the finished product affects its selling price. In addition, this demand on the steam output, supplied largely by the new steam unit, imposes a 70% makeup requirement on the boiler.

Fig. 1 shows the various steam-supply headers and the levels into which the boiler and the recovery unit feed. The high-pressure header receives 450-psi 750-F steam from both units. It supplies (1) a 3500-kw backpressure turbine (2) two reducing valves, each capable of passing 186,000 lb of steam per hr (3) two steam-driven 300-gpm boiler feed pumps. A third 300-gpm electric-driven pump replaces one of the steam-driven units when the heat balance dictates the need. The turbine and reducing valves deliver steam through carburetor-type desuperheaters to a 125-psi 400-F header for process needs. These desuperheaters hold the header steam temperature to 400 F.

The 3500-kw 400-psi turbine operates in connection with a 7000-kw hydro-electric plant. Two 125-psi condensing turbines, 1000 and 1250 kw, operate when needed.

This 125-psi header receives steam from several smaller-capacity water-tube boilers and a number of hrt units, which have been in operation for some time, in addition to steam from the high-pressure turbine and reducing valves.

Water Cycle. Condensate returns from process amount to only about 30% of the steam-generator output. Chlorinated raw water for all plant services passes through sand filters on the way to a storage hotwell tank. Flash steam from digesters exhausts into a closed heater that raises the temperature of the incoming water fed to the storage tank. Condensate returns from heating coils, first effect of multiple-effect evaporators, and steam driers enter into this storage tank. A 600-gpm booster pump pulls the needed 70% makeup water from this level to a deaerator.

The Deaerator. At this point all the remaining condensate and makeup meet. Into the unit comes the exhaust from the steam-driven boiler feed pumps and a live-steam line from the 125-psi header for any temperature regulation needed at this level. Two relief valves act as safety vents if pressure builds up beyond a 3-psi level. When live steam is admitted through a regulating valve, one of the relief valves, a variable-port type, is cut out to prevent it lifting too early.

The deaerated water enters a storage tank that provides a positive suction to the boiler feed pumps. These pumps deliver water at 650 psi to the boiler.

Feedwater Treatment. Water for steam service undergoes three stages of preparation (1) caustic soda and sulphite treatment at the raw-water hotwell level (2) mechanical removal of dissolved CO_2 and O_2 at the deaerator level (3) proportioned disodium phosphate and caustic soda treatment at the boiler drum. Results of the chemical treatment are shown in Table I. The proportioned chemical entering the boiler drum is delivered by a 20-gal-per-hr proportioning pump.

Steam delivered by the steam generator is of excellent purity. It is released above the boiler-drum working level and passed through a cleaning and drying system, Fig. 2. Here a baffle directs the steam from risers in the boiler circulating system downward to contact cooler feedwater entering at this point in the drum. This contact gives a washing action to the steam. Condensate formed by this action keeps the scrubber sections wetted to

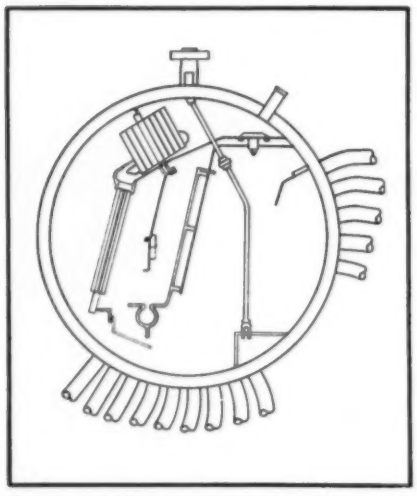


Fig. 2—Finished product needs pure steam. Drum internals (baffle, scrubber and drier) insure excellent purity

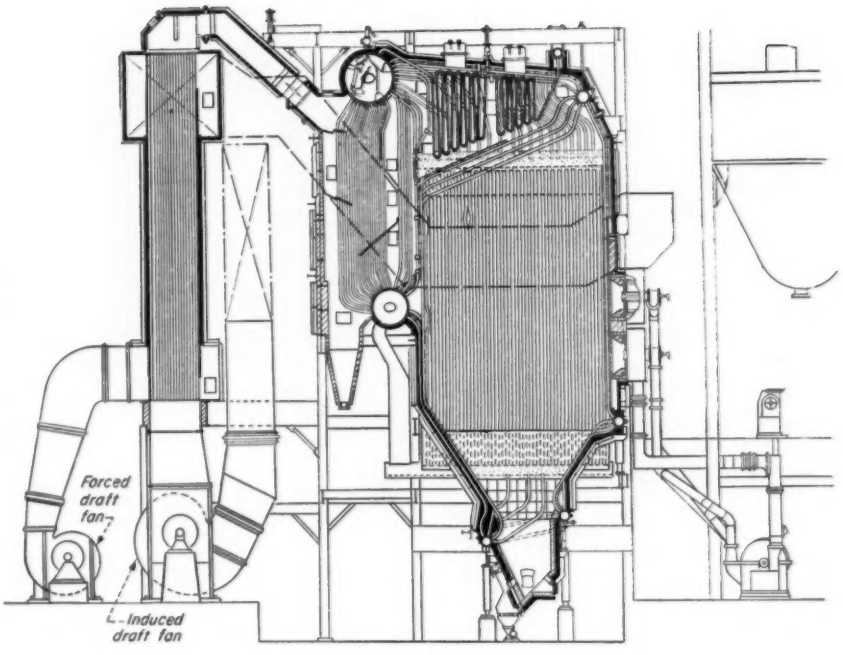


Fig. 3—A 200,000 lb per hr boiler, the largest in Maine, shows location and proportion of steam generating areas

give a greater washing area. After the cleaning, steam passes through the drier where it is delayed long enough to settle out entrained moisture.

Fuel and Combustion. Coal for the four burners comes from a 650-ton acid-resistant bunker by way of two 16,800-lb-per-hr attrition-type pulverizers. Coal is fired through flare-type burners into a 11,000-cu-ft dry-bottom furnace with a heat release of 25,500 Btu per cu ft per hr. At full-rated load of 200,000 lb per hr the steam-generator efficiency is 86%.

Recovery Unit. Operation of the 100-ton soda recovery unit follows this pattern. The original liquid for cooking the pulp becomes enriched in organic and inorganic solids picked up from the wood undergoing cooking. From here as black liquor it enters a washer for removal of wood fiber. When the liquid leaves the washer it has a solid content of about 15% by

TABLE I—CHEMICAL TREATMENT
SAMPLE WATER ANALYSES REPORT SHEET
PENOBSCOT CHEMICAL FIBRE CO.—GREAT WORKS, ME.

Sample marked	Raw	Feed	Boiler	Boiler Condensate	No. 120 Condenser
Analysis number	E2670	2671	2672	2673	2674
Turbidity as SiO_2, ppm	Trace	Trace	Present	Trace	Trace
Oil, ppm	—	3.5	—	4.4	Trace
Ammonia as N, ppm	—	—	—	0.15	0.25
Carbon dioxide as Co_2, ppm	—	—	—	10.0	4.0
Total hardness as $CaCo_3$, ppm	16	16	0	—	—
Phenolphthalein alkalinity as $CaCO_3$, ppm	0	0	492	—	—
Methyl orange alkalinity as $CaCO_3$, ppm	12	16	704	—	—
Sulphate as SO_4,ppm	12	8	224	—	—
Chloride as Cl, ppm	1.0	1.0	32	—	—
Silica as SiO_2, ppm	7	—	150	—	—
Phosphate as PO_4, ppm	—	—	150	—	—
Sulphite as SO_3, ppm	—	—	—	—	—
pH	6.9	7.3	11.9	5.3	6.3
Specific conductance, micromhos	—	—	2400	5.6	5.8
Specific conductance, micromhos (corrected)	—	—	—	1.4	2.5

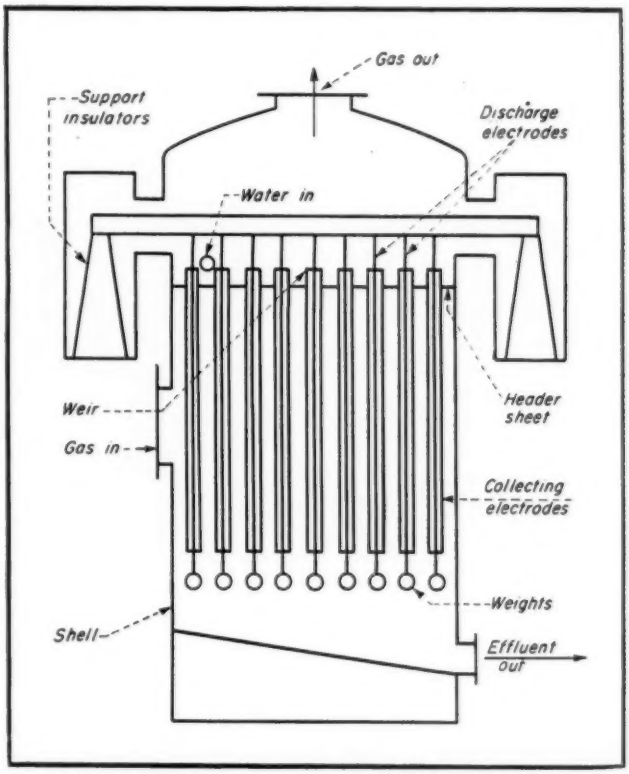


Fig. 4—Single-stage wet-type electrostatic precipitator such as this recovers 93% of soda in the flue gas of Fig. 5 unit

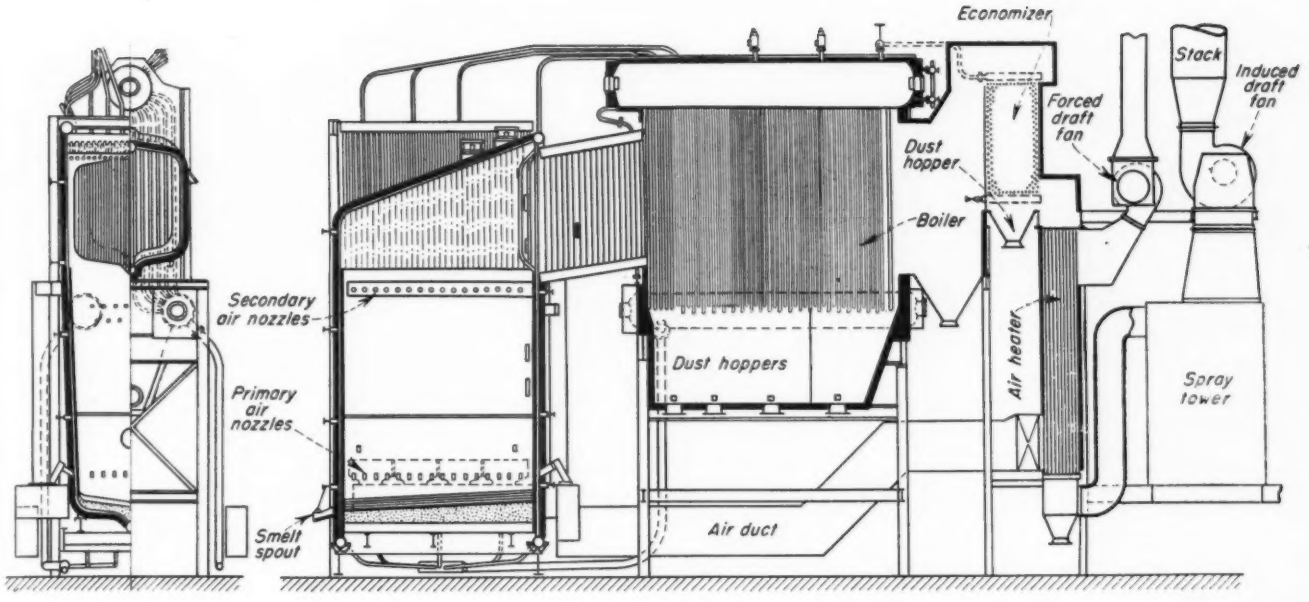


Fig. 5—Heat-recovery unit fires black liquor from pulp-cooking process. The fuel is sprayed into the furnace through nozzles in each sidewall. Fine combustible particles burn in suspension, driving off moisture. Remaining solids fall to the bottom as a molten ash or smelt. Hot combustion gas enters waste-heat recovery boiler (right)

weight. It is then passed through multiple-effect evaporators, which raise the solid content to 60-65% by weight.

The black liquor with a Btu value of about 6000 on the dry basis is now ready for firing. It is introduced to the furnace, Fig. 5. by firing through a set of nozzles, one spotted in each sidewall and directed towards the floor. Primary air at 400 F from an air heater comes in at the bottom of the furnace bed. Secondary air uses separate nozzles located in all four walls.

The black liquor sprays across the furnace chamber to splash against the opposite wall where it forms a char. This spray method gives considerable time for dehydration and allows most of the combustibles to burn in suspension. The secondary air steam admitted to the furnace at a level above the spray joins the combustibles at an angle that promotes turbulence and mixing. Solids left behind fall to the furnace bottom as a molten ash.

Furnace temperature is so high that the smelt remains molten and runs off continuously to a collecting tank where it dissolves in a water solution to form a green liquor. The runoff solution passes through several stages including a causticizing one before it is reintroduced to the cycle in a cooking tank.

The combustion gas formed in the furnace carries a burden of finely divided chemicals, mostly carryover from the suspension burning of the black liquor. The boiler design of this unit has no baffling and allows an uninterrupted passage for the gas through the boiler so the solids do not build up a heavy deposit on the tubes. Hand lancing removes any deposit that does form, and collecting hoppers along the gas travel receive settled-out solids.

Electrostatic Precipitator. All other solids not settling out on tube surfaces pass along with the gas stream to enter a gas scrubber. From there the gas and its entrained solids are directed to an electrostatic precipitator.

The precipitator, a single stage, wet type, Fig. 4, is built in a cylindrical tank with a header sheet near the inside top. A battery of 8-in.-dia tubes or pipes nest into this header. They are the collecting electrodes. High-voltage rods carrying 75,000 v hang from supports above the header sheet and pass through the center of the collecting tubes. A weak sodium-carbonate solution flows over weir rings at the tops of these collecting pipes to form a water film on the inside of the pipes. The charged gas-borne sodium-carbonate particles are neutralized in the solution and wash off to the bottom of the precipitator. This unit normally recovers 93% of the soda in the gas.

PRINCIPAL EQUIPMENT IN MODERNIZATION

BOILERS AND AUXILIARIES:

Boiler, 1, 200,000 lb per hr, 450 psi, 730 F; total waterwall heating surface, 17,610 sq ft.....Riley Stoker Corp
Boiler, 1, 60,000 lb per hr, 450 psi, saturated, Tomlinson recovery unit, sloping bottom.....Babcock & Wilcox Co
Superheater, 1, combined radiant and convection, pendant.....Riley Stoker Corp
Air heater, 1, 29,000 sq ft, tubular.....Riley Stoker Corp
Pulverizers, 2, 16,800 lb per hr, motor driven, 150 hp.. Riley Stoker Corp
Ash-removal system, 1, 30-ton capacity.....United Conveyor Corp
Feedwater treatment.....W H & L D Betz

PUMPS AND PIPING:

Boiler feed pumps, 3, 300 gpm, 650 psi, 3550 rpm; 2 steam-driven, 1 motor-driven.....Ingersoll-Rand Co
Booster pump, 1, 600 gpm, motor driven, 60-ft head.....Goulds Pumps Inc
Reducing valves, 2, 6 in., 450 to 125 psi, 186,000 lb per hr.....Swartwout Co
Reducing valve, 1, 2½ in. regulating, ½ to 10 psi.....Swartwout Co
Relief valve, 1, 6 in.....Swartwout Co
Relief valve, 1, 10-in. multiport, 3 psi.....Cochrane Corp
Desuperheaters, 2, carburetor type, holds steam at 400 F; 1, jet type, turbine exhaust.....Swartwout Co
Deaerator, 1, 250,000 lb per hr, 0 to 2 psi.....Cochrane Corp
Chemical feedwater pump, 1, adjustable feeder, 20 gal per hr.....Proportioneers, Inc

GENERATING EQUIPMENT:

Turbine, 1, 3500 kw, backpressure, 4160 v, 60 cycles....General Electric Co

DUST COLLECTOR:

Electrostatic precipitator, 1, single stage, wet type, Cottrell, 75,000 V.....Western Precipitation Corp

MINING COAL by modern mechanized methods introduces additional surface moisture by the spraying operations carried on at the mining face. Knowing moisture range about some average value aids in making a proper fuel selection

Know Coal and Its Selection

Here are the properties for all ranks of coal that influence furnace combustion. Using this information as a starter you can select the proper coal for any firing equipment and then take the right operating steps to get smokeless operation

By **L N ROWLEY**, *Managing Editor*, and **J C McCABE**, *Assistant Editor*

▶WHAT DO WE NEED TO KNOW to handle coal, our greatest energy source, so that it doesn't contribute to atmospheric pollution? Our knowledge should cover (1) a clear picture of the nature of the fuel itself (2) principles of coal combustion. and (3) kinds of burning equipment used and how they operate. Let's start with first things first—the nature of coal as fuel.

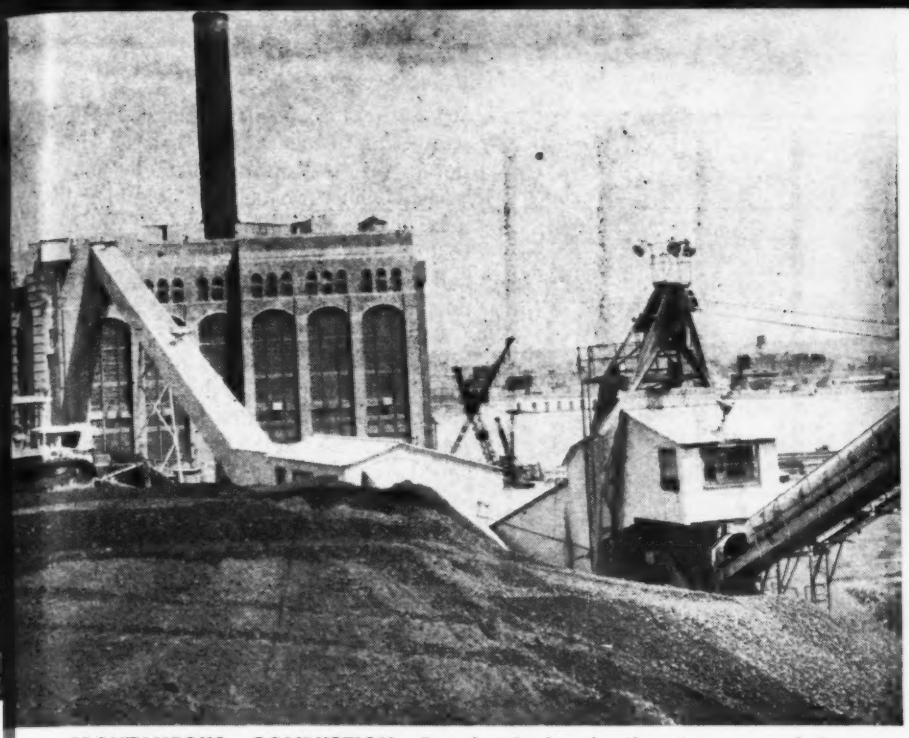
Three-hundred million years ago, in the swamp forests of the Carboniferous Age, the foundation of our present coal supply was laid. For fifty million years, giant trees and ferns grew and fell, to decay and form rich peat bogs. Floods buried the bogs under layers of sediment, only to subside and permit the cycle of growth and decay to begin again. As millions of years passed, pressure, heat and time worked together to drive off some volatile matter, harden the mass, and turn it into the carbon-substance we call coal.

Coal Classification. Different kinds of coal contain different amounts of carbon-substance, depending on the age of the deposit and the conditions under which it was formed. Next to the original peat, the "youngest" form of coal is *lignite*, high in moisture and low in fixed carbon. Older coals, higher in "rank," contain more fixed carbon. The chart on p 86 shows a classification of coals prepared by U. S. Geological Survey.

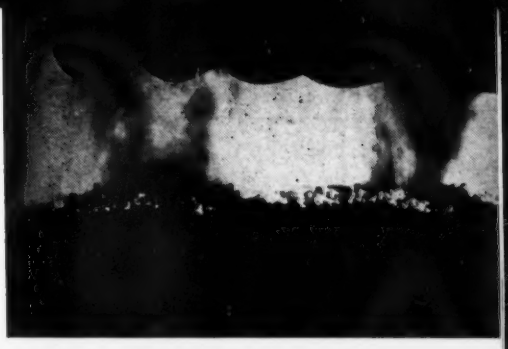
In addition to these broad differences between coal types or ranks, there are many variations within any one group or class. For this reason, the suitability of any one coal for a specific job must be judged on the basis of a large number of properties or characteristics. Accordingly, a considerable variety of methods of analysis and test have been developed to permit comparing coals for behavior in the furnace and during handling and storage.

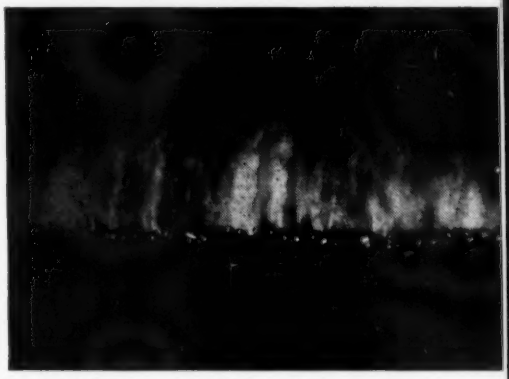
Types of Analyses. *Ultimate analysis* of a coal shows the exact chemical composition, without regard for the form in which the elements actually appear. For example. the total amount of carbon is reported, including fixed carbon and that combined with hydrogen in the hydrocarbons of the volatile matter. Ultimate analysis finds its principal use in combustion calculations.

For a better picture of practical coal properties, we turn to the proximate



SPONTANEOUS COMBUSTION—fire developing in the storage coal from accelerated weathering—almost never occurs if layer piling and compacting is used





COAL-SIZE segregation gives upper fire. Good size consist gives lower

For Smokefree Combustion

analysis. This involves determining the percentage of moisture, ash, volatile matter, and fixed carbon. These represent the components of coal, *as they actually occur*. The percentages add up to 100. In addition, it is customary to determine: (1) total amount of sulphur, expressed as a separate percentage (2) ash-fusion temperature and (3) heating value, in Btu. Let's look briefly at the meaning of each factor in the proximate analysis.

Moisture. All coal contains some natural moisture. This *inherent moisture* lies in the pores of the coal, forms a true part of it, being retained when the coal is air dried. *Surface moisture* is just what the name implies, an extraneous substance. With the advent of mechanized mining, and the associated heavy spraying operations, surface moisture becomes a greater factor in coal as received. Its amount varies with geological conditions at the mine, spraying operations at the mining face, length of time in transit, weather conditions, storage period. Since moisture figures large in preparation. handling and combustion of coal, its range about some average value is an important consideration.

Volatiles, Carbon. In a way not yet clearly known, coal holds combustible hydrocarbons, which are released by heat, leaving behind a solid fuel, consisting, in the main, of carbon, but containing some hydrogen, oxygen, sulphur and nitrogen not driven off with the gases. The percentage of *volatile matter* indicates the amount of gaseous fuel present and thus bears a direct relation to the mechanics of firing. Unless furnace volume and arrangement of heating surfaces are properly related to the volatile characteristics of the coal and adequate provision made for completely burning the gaseous products, smoke forms. Thus volatile content bears a definite relation to smokeless combustion.

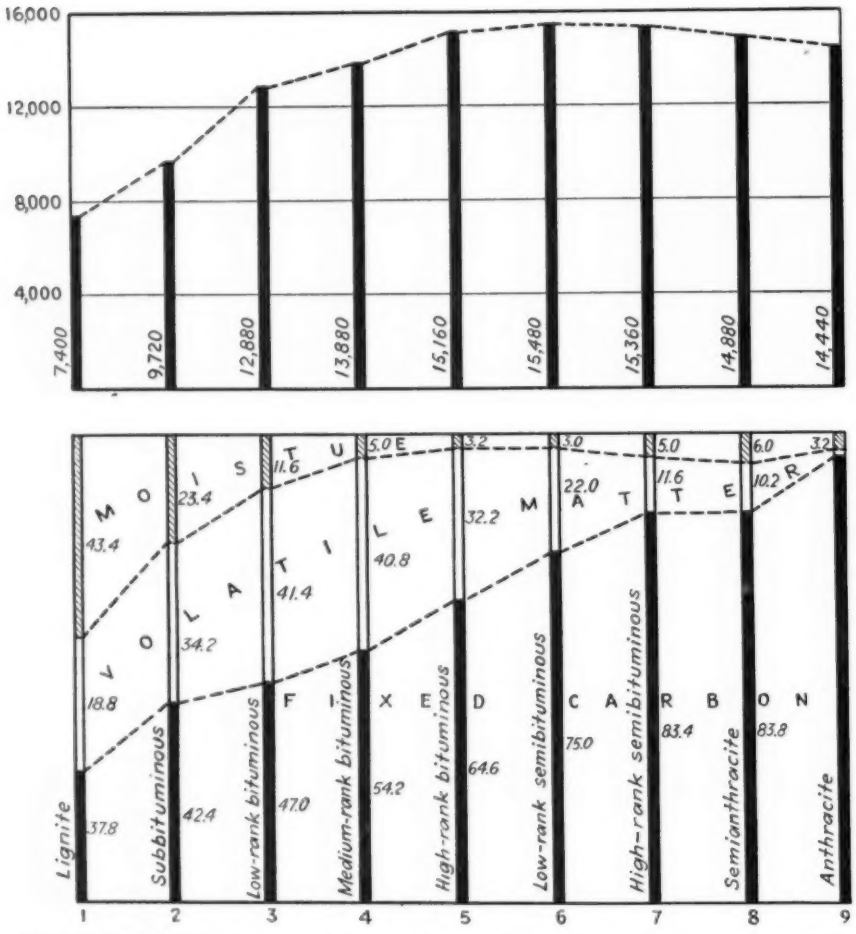
Ash Characteristics. It has been said that nothing is more important to successful burning of coal than the amount and nature of the ash, the incombustible mineral matter left behind when coal burns completely. It differs from "ashes," as the power-plant operator knows them, because ashes taken from a furnace always contain some unburned coal. Like moisture, ash is an impurity which increases shipping and handling costs. It must be removed from the furnace and the plant, usually requiring additional equipment and expense. On the other hand, a minimum ash content is essential for grate protection in some forms of fuel-bed firing.

Perhaps even more important, combustion-wise, is the nature of the ash. Much remains to be learned of the relation between chemical composition of ash and such practical problems as slagging and clinkering, but *ash-fusion temperature* (and sometimes the spread between initial and softening temperatures or between softening and fluid temperatures) serves as the best single indicator of clinkering and slagging tendencies.

Sulphur. An undesirable element, sulphur, plays a part in clinkering and slagging, in corrosion of air heaters, economizers, breeching and stacks, and in spontaneous combustion of coal. It occurs mainly as iron sulphide (pyrites), as organic sulphur, and in small amounts as sulphates. Only total sulphur is measured, although it is believed that iron combined with sulphur shares the blame for troubles laid to sulphur.

The bearing of the proximate-analysis factors on coal behavior in a power plant is evident. It is likewise evident that more information is needed for intelligent selection of coal for a given job. To meet these added needs, other characteristics are measured and tested.

Coal Sizes. Coal size affects the nature of the fuel bed, draft needed,



RANK VARIATIONS show in fixed carbon, volatile and moisture of coals from lignite to anthracite on ashfree basis (below); comparative heat values (upper)

density of coke formed, and amount of unburned carbon lost up the stack. Bituminous coal, 90% of which goes to the industrial market, comes in a variety of sizes. *Run of mine* is unscreened coal as it comes from the mine.

If size is specified for bituminous, it is usually by screen opening. A "2-in. nut and slack" means all coal passing a 2-in. screen. Between-screen sizes (everything passing one screen, retained on another) gives a closer idea of size. since percentage of fines may be considerable unless a limit is set. For pulverizers, common sizes are ¼-in. x 0, ⅜ in. x 0, ¾ in. x 0. Nut-slack sizes for stokers run 1¼ in. x 0, 2 in. x 0. Domestic stokers usually need a double-screened coal with top size about 1 in.

Size Consist. Older plants often need specially sized coals for good performance, and the *screen analysis* or *size consist* must be known. This describes the proportion of the various sizes that exist in a given supply. The importance of such a consideration in plants faced with, say, segregation troubles can be seen when we realize that a 2-in. nut and slack, for instance, might actually prove to be nearly all fines.

Storage Characteristics. Although coal size as received may be known, size as fired, after handling, may prove quite different. Ability to resist breakage and size change in handling is known as *size stability*. *Friability* is the opposite, a measure of the tendency of a coal to break or crumble into smaller pieces.

When coal is stored for relatively long periods outdoors, *weathering* occurs. It is an extremely slow form of combustion, dulling the coal, reducing its size, impairing firing and coking qualities, lowering heating value. Anthracite suffers no noticeable weathering effect, bituminous only little. Lignite and low-rank bituminous show marked weathering.

If heat liberated by weathering is confined to a small area, a temperature rise follows, increasing the rate of oxidation. This cycle of higher temperature and faster oxidation continues until definite "hot spots" form and *spontaneous combustion* occurs. While weathering tendency is a characteristic of the coal itself, whether spontaneous combustion occurs depends to a large extent on the care with which coal is piled for storage. Layer piling and compacting reduce the possibility to a negligible point.

Grindability. For specific firing methods, characteristics other than those determined by the proximate analysis need to be known. In pulverized-firing, for example, *grindability*, or relative ease of pulverizing, proves essential information. It figures as one factor in established pulverizer capacity and influences pulverizing cost.

The American Society for Testing Materials approves two methods of measuring grindability: (1) ball mill, a laboratory procedure, and (2) Hardgrove machine, more commonly used, which provides a comparison with a standard coal of grindability 100. Ball-mill method involves measuring the relative amounts of energy required to pulverize different coals by counting the number of revolutions to grind until 80% passes a 200-mesh sieve. Hardgrove machine is based on Rittinger's law: "The work done in pulverizing is proportional to the new surface produced." A prepared sample receives a definite amount of grinding energy in a miniature pulverizer and the new surface produced is determined by sieving. An approximate conversion from ball-mill index to Hardgrove can be made from the chart on p. 87.

Coking and Caking. Formation of coke, in one shape or another, represents an intermediate stage of combustion in any fuel bed. Some coals become plastic and form lumps of coke. Such coals are called *caking* coals, while those that show little or no fusing action are *noncaking* or *freeburning*. A *coking* coal is usually described as one used in commercial coke making. The term thus refers to coals which, upon heating to the point where volatile matter is driven off, leave behind lumps of coke of marketable size.

Caking properties of a coal and the nature of the coke lumps formed (size, strength, etc) indicate behavior of a coal on the grate. A proposed ASTM test for *agglutinating value* gives an approximate measure of the material in a coal that becomes plastic on heating. Still another information source of this nature lies in a study of the coke buttons left after the standard volatile-matter test.

This necessarily brief review of coal properties and the way they are measured and judged indicates clearly that

coal is a complex fuel and its successful combustion depends on securing the proper relation between the fuel on one hand and the nature of furnace and firing equipment on the other. Future articles will take up detailed study of the connection between specific coal properties and the mechanism of combustion, also the various firing methods. At this point, however, we will summarize briefly the main lines of attack in selecting coal for a specific case.

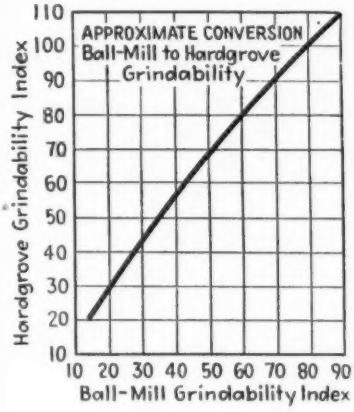
Coal Selection. New and existing plants offer a sharp contrast in coal selection. If a plant is yet to be built, nothing is fixed, and so the intelligent approach is, in general, to select the coal or coals to be employed and adjust plant design accordingly. In an existing plant, characteristics of the handling and firing equipment cannot normally be altered and the coal must be selected to meet these fixed requirements. This difference cannot be too strongly emphasized.

In a new plant, the problem is to get a combination of fuel and equipment that meets all operating requirements, both present and future, with lowest over-all cost. A thorough-going fuel survey should precede everything but the decision to build the plant, since fuel choice affects practically every item in the boiler plant. The threefold purpose of such a survey is to: (1) find out what coals are available in a given area (2) establish the relative value of these fuels, and (3) attempt to predict, or at least allow for, changes in relative value in future years. It would be wrong to say this is a simple job but there is no part of the design that pays bigger dividends over the life of the plant.

With information from the Bureau of Mines and the U. S. Geological Survey, an engineer can compare the extent, quality and characteristics of the available coals and pick several sources of suitable fuel. Next, his marketing sense will dictate a weighted comparison of factors like delivery costs, market-price and production-cost history, present and future availability. This should lead to a primary and a secondary choice.

Primary choice may well be a coal produced by a number of mines operating from the same seam to give a product of substantially the same quality. Its characteristics largely set the specifications for plant design. The secondary or alternate selection should differ enough from the primary to permit competitive purchasing. It should be a coal from a different seam and possibly a different region. Its characteristics should roughly fit the specifications imposed on firing equipment by the primary selection. Or, more properly, this equipment should be designed to handle coals having the quality and characteristics of both primary and secondary choices.

Hardgrove Grindability: Values of Typical Coals



State	County	Seam	Grindability
Ill.	Christian	No. 6	57
	Fulton	No. 5	65
	Jackson	No. 6	75
	Saline	No. 5	58
Ohio	Belmont	Pittsburgh No. 8	57
	Jefferson	Pittsburgh No. 8	58
	Tuscarawas	Pittsburgh No. 6	57
Pa.	Allegheny	Pittsburgh	62
	Cambria	Lower Kittanning	104
	Fayette	Pittsburgh	61
	Jefferson	Lower Freeport	96
	Somerset	Upper Kittanning	100
	Westmoreland	Pittsburgh	63
Tenn.	Anderson	Pee Wee	43
Va.	Dickenson	Upper Banner	85
	Tazewell	Pocahontas No. 3	104
W. Va.	Boone	Winifrede	40
	Fayette	Sewell	95
	Kanawha	Coalburg	43
	Marion	Pittsburgh	56
	McDowell	Pocahontas No. 3	103
	Monongalia	Pittsburgh	64
	Raleigh	Beckley	104

Existing Plants. In an existing plant, equipment characteristics set the pattern, so coal selection starts with a *plant* survey. The right coal for the plant will carry the load, burn smokelessly, meet all reasonable operating requirements and produce lowest overall steam cost.

To eliminate a lot of trial-and-error fumbling, the engineer must examine every part of his plant, from coal pile to ashpit and stack, with but one thought in mind, to locate and evaluate every factor affecting coal selection. Even the engineer familiar with his plant will find such a fuel-engineering analysis reveals limitations he wasn't aware of or puts the finger on the exact cause for some limitation only vaguely recognized. Of equal importance, he will find that some limitations thought to exist will disappear on close examination. From such an analysis of plant handling and firing characteristics it becomes possible to write a coal specification just as a doctor writes a prescription after thorough examination and diagnosis.

In making the plant survey, experience and records will furnish some of the answers easily and definitely; others will have to be determined by trial. For example, a low boiler setting causes smoke trouble at high burning rates with high-volatile coals. The engineer knows this but has no records that would indicate the maximum amount of volatile matter that will permit operation at high rates without exceeding smoke requirements. A few tests with sample shipments of coal will give the answer needed.

Considering the furnace and firing equipment, it will be found that each factor of design must be analyzed in relation to the burning rates encountered and to the nature of the load; that is whether it is steady or fluctuating. For example, the minimum ash-fusion temperature for clinker-free operation on an underfeed stoker depends largely on combustion rate. Likewise, nature of the load affects the importance of caking qualities of coals; existence of a fluctuating load may bar a strongly caking coal from use on a stoker with inadequate agitation of the fuel bed, or from a hand-fired grate.

It should not be assumed from the foregoing that coal selection is the most important factor, or even necessarily a major one, in successful smokeless combustion. There are plants in which any coal within reason burns smokelessly and there are others in which no coal does a good job. It is fair to say, however, that knowledge of coal characteristics and wise selection are essentials that, combined with adequate equipment *and good operation*, produce the desired pollution-free results.

Future articles will relate coal characteristics, firing equipment, combustion principles and operating methods, for each commonly used firing system.

Photometer Measures Dissolved Silica

If color is compared visually, the usual colorimetric test loses much of its reliability and sensitivity from eye error. Here is a new method that will eliminate the personal factor

By N I SAX, *Works Laboratory, General Electric Co*

► USABLE SURFACE WATERS vary in soluble silica content from about 1 to 60 ppm, while well waters range all the way from 1 to over 100 ppm. With present-day equipment silica is becoming more and more objectionable as a constituent of boiler feedwater. It may be true that in installations operating below 500 psi the boiler water can tolerate a fairly high silica content by maintaining a methyl orange-phenolphthalein alkalinity ratio of at least 1.1, precipitating any traces of calcium hardness with phosphate, excluding aluminum from the feedwater, and keeping up good circulation, but it is also true that in higher-pressure plants this method does not work well. Here it becomes advisable to keep alkalinity down to a minimum to prevent carryover and formation of carbon dioxide in the steam.

Furthermore, carryover of silica with turbine steam is particularly serious because it forms a hard and adherent scale on superheater tubes and turbine blades with consequent loss of efficiency.

To overcome this difficulty it is desirable to keep the concentration of silica in boiler water as low as 5 to 7 ppm, which means that makeup-water content must run as low as 2 to 4 ppm. For example*:

Boiler-water limits:
- total solids..... 1000 ppm
- silica ..... 15 ppm

Feedwater limits:
- total solids ..... 200 ppm
- silica ..... 5 ppm

then, 1000/200 = 5 concentrations

and 15/5 = x = 3 ppm silica

Engineer's Needs. For reducing failures and efficiency losses from silica-scale formation in boilers, superheater tubes and turbine blades. a plant engineer must have at his disposal an accurate method for determining silica content of feed or boiler water. There are a variety of procedures for estimating silica, which are simple and rapid without sacrificing accuracy. They range from the gravimetric, requiring delicate balances, platinum ware, muffle furnaces and a variety of chemicals, to the molybdisilicic-acid or molybdenum-blue color methods.

One of the newest and most effective methods, however, utilizes a simple, rapid, highly accurate photometric precedure for estimating minute amounts of dissolved silica by means of the well-known and widely used yellow molybdisilicic acid complex color. It requires neither a highly trained operator nor complex facilities, and the instrument need not be expensive.

Silicic acid forms an intensely yellow-colored complex with ammonium molybdate, and is the basis of the standard method of the American Public Health Association for analyzing water to determine its dissolved-silica content.

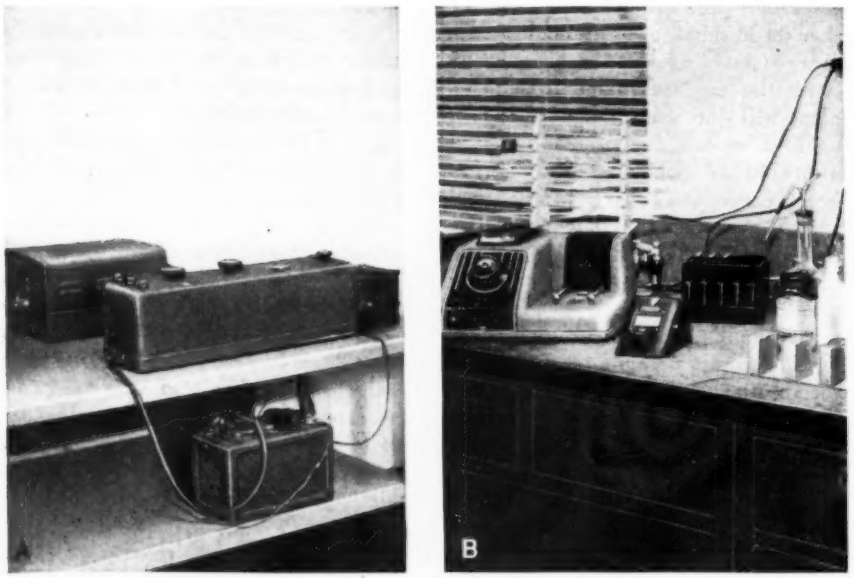
Eye Error. But when the colorimetric procedure is used in the ordinary way—final estimation or comparison of the color produced is based upon visual observation—much of the method's reliability and sensitivity is lost because it is difficult to prepare comparison standards each time a test is made.

It is possible, of course, to make up a set of standards each time, but this is cumbersome because it requires extreme care and even in well-equipped laboratories it is nearly impossible to prepare silica-free water for dilution purposes or for rinsing the apparatus. Only practical solution is to prepare permanent standards.

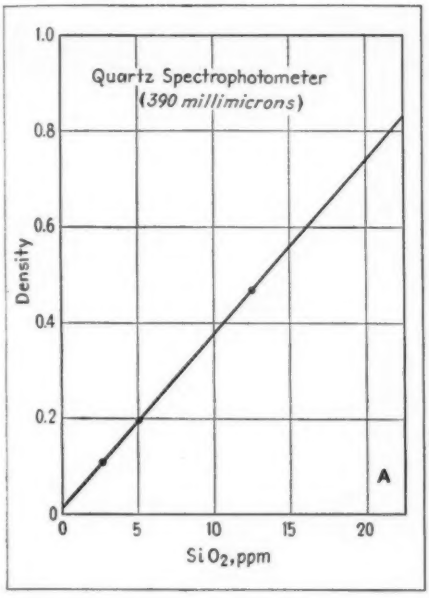
Ordinarily, the silica content of industrial waters ranges from 1 to 100 ppm. This requires either a large number of well-spaced standards or a few standards that are far apart. Moreover, accurate control for high-pressure-turbine installations requires sensitivity to at least 0.5 ppm. which is none too great, since at the 4-ppm level an error of 1 ppm amounts to 25%.

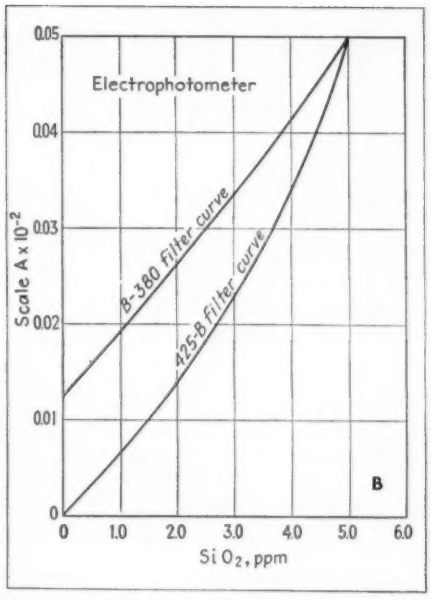
Furthermore, even if it is possible to obtain artificial. permanent standards

* Oldest successful procedure for reducing the silica content of water is with ferric-sulphate. Its modern counterpart, used by railroads, circulates the water to be treated in a tank containing cast-iron chips. Figures cited are based on the Permutit Magnesia Process.



NEW METHOD. Either quartz spectrophotometer (A) or filter-type photoelectric colorimeter (B) permit accurate color estimation and sample-color evaluation





GRAPHS SHOW (A) relation between concentration of dissolved silica and density; (B) electrophotometer readings with two filters on silica concentrations

II—Readings of An Electrophotometer With Different Filters

Vol of standard, ml	380 millimicron filter	425 millimicron filter
0	0.0125	0.0000
0	0.0125	0.0000
1	0.0300	0.0180
1	0.0300	0.0180
2	0.0500	0.0500
2	0.0500	0.0500

425 millimicron filter, wavelength*	Transmission, %	425 millimicron filter, wavelength*	Transmission, %
390	41.5	330	71.5
400	51.5	340	83.5
410	56.5	350	82.5
420	58.5	360	86.3
423	57.0	370	84.0
426	56.5	380	80.5
430	55.8	390	74.0
		400	59.0
		410	41.0

*Wavelength in millimicrons

in steps of 0.5 ppm of silica concentration, it is extremely difficult to work with them visually. At the higher concentrations, the eye is not able to differentiate accurately between successive steps.

In addition, all visual comparison methods have the same fundamental weakness—the *personal factor*, or unavoidable eye error between different individuals performing the same analysis. On the other hand, there is little question of the superiority of spectrophotometers or photoelectric colorimeters when it comes to accurate estimation of color and consequent evaluation of the sample.

New Method. The following procedure was, therefore, developed with the aid of a quartz spectrophotometer. It is also entirely satisfactory for routine use with a simple, inexpensive, filter-type photoelectric colorimeter (photos on preceding page). A complete test can be made in 8 to 10 min, accuracy is within 1%, range is 0 to 100 ppm, and interference moderate to large amounts of PO_4 ion.

Procedure:

1. Pipette 25 ml of sample into a 250-ml Erlenmeyer Pyrex flask.
2. Add 2 ml of 3N HCl.
3. Add 5 ml of 2.5% ammonium molybdate solution.
4. Heat to 80 C.
5. Cool rapidly to room temperature.
6. Add 5 ml of 1.1% NaF solution.
7. Read at 390 mu on spectrophotometer or with suitable filter on photoelectric colorimeter.

Sample should be approximately neutral. If it is quite acid, add pure anhydrous sodium carbonate (low in silica content) to make the water neutral to litmus paper. A very good grade of this reagent with a silica content of 0.005% is commercially available. If water is alkaline, neutralize it to litmus paper with a few drops of concentrated hydrochloric acid added to a liter of the sample.

Filtering by suction through a perforated Gooch crucible containing a filter disk of ashless, hardened, acid-washed filter paper removes suspended matter.

The flask should be well washed, rinsed first with 8N hydrochloric acid, and then several times with distilled water. Keep it covered with a 50-ml Pyrex beaker between additions, and particularly while it is being heated.

Preparing Reagents. Make the 3N hydrochloric-acid solution fresh each time from a bottle of concentrated acid (cp reagent grade).

Ammonium molybdate solution is made by dissolving 2.659 g of cp reagent-grade ammonium molybdate in 100-ml of distilled water in a wax bottle. Keep the bottle covered and make fresh reagent every week. The flask can be heated to 80 C by placing it for 1 min on a hot plate having a surface temperature of 300 C. At any rate, heating should be quite rapid, and the flask covered with a 50-ml beaker. It should then be placed in a cooling bath or under a tap, and care taken to keep water and spray out of the flask.

The sodium-fluoride solution is made by dissolving 1.1 g of a special grade of sodium fluoride, which contains only 0.007% sodium silicofluoride, in 100 ml of distilled water in a wax bottle. This reagent should be made up fresh as often as the ammonium molybdate.

With the quartz-type spectrophotometer, a wavelength setting of 390 millimicrons was found to be best, using 1 cm silica (fused) cells and distilled water as reference material.

If silica content is 100 ppm or more, procedure can be standardized, using only 10 ml of sample and bringing up the volume to 25 ml with distilled water. On the other hand, if the work is done

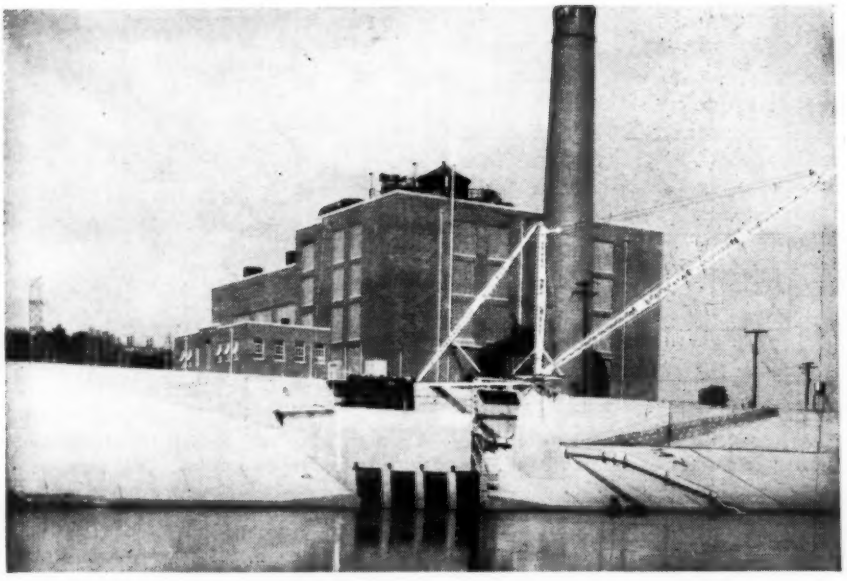
(*Continued on page* 152)

I—Density Readings For Various Wavelengths

Vol of standard, ml	Wavelength settings 380	390	400	410	420
0	0.020	0.008	0.002	0.000	0.000
0	0.019	0.007	0.002	0.000	0.000
1	0.152	0.108	0.078	0.056	0.037
1	0.148	0.106	0.077	0.054	0.035
2	0.263	0.196	0.144	0.105	0.072
2	0.264	0.197	0.145	0.106	0.073
5	0.620	0.467	0.353	0.264	0.184
5	0.619	0.467	0.353	0.264	0.184

Mississippi Power Company Increases

Convenient placement of station equipment and integral-unit design mark the layout of gas-fired plant. All units are planned to be duplicates with provision for future pulverized-coal firing if needed

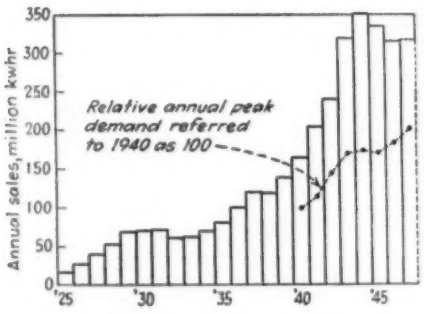


PLANT EATON WITH INTAKE AND DIKE in foreground. Building which houses two single-turbine single-boiler units, will be extended to right for additions. Crane removes silt deposits from front of water intake to downstream side

▶ GENERATING FACILITIES of the Mississippi Power Co operate as a unit with the Southeastern system of the Commonwealth and Southern Corp. Before 1945 the Mississippi Co purchased almost all energy from the regional system, since it had only four small steam plants, of 7500-kw capacity and less, which served principally as standby.

Since the late 1930s, local energy and power demands have increased rapidly because of growing industrialization of the area. This required the placement of large, firm generating capacity within the local system. Accordingly, the engineering group of the Commonwealth and Southern Corp, southern division, projected and designed the first unit of Plant Eaton, on the Leaf River near Hattiesburg, Miss. Construction was started Feb 1944 and Unit No. 1 went into operation March 22, 1945. Unit No. 2, a duplicate of No. 1, started operating July 3, 1947. A third unit is on order to start in 1949.

Plant Layout. Each turbine-generator receives steam from a single boiler operating essentially as a separate station. Steam and feedwater mains will be tied together to permit interchange of steam between units during emergencies. Turbine end of each generating unit faces its boiler with no partition separating them. Turbine- and boiler-control boards are placed back to back as shown in the station cross section. Plant is laid out to contain four units ultimately, with a total capacity of about 100,000 kw. Turbines and boilers of each unit are placed side by side.



GROWTH OF ENERGY DEMAND exceeds national experience. Peak-load increase requires third unit by 1949

Steam Generators. Each unit has a standard Riley Stoker 3-drum boiler capable of delivering 230,000 lb per hr continuously at a design pressure of 975 psi. The convection-type superheater maintains 860-F steam temperature from 140,000 lb per hr to maximum flow by aid of a bypass damper control. The steel-encased unit has a watercooled furnace with wall tubes tangent-spaced.

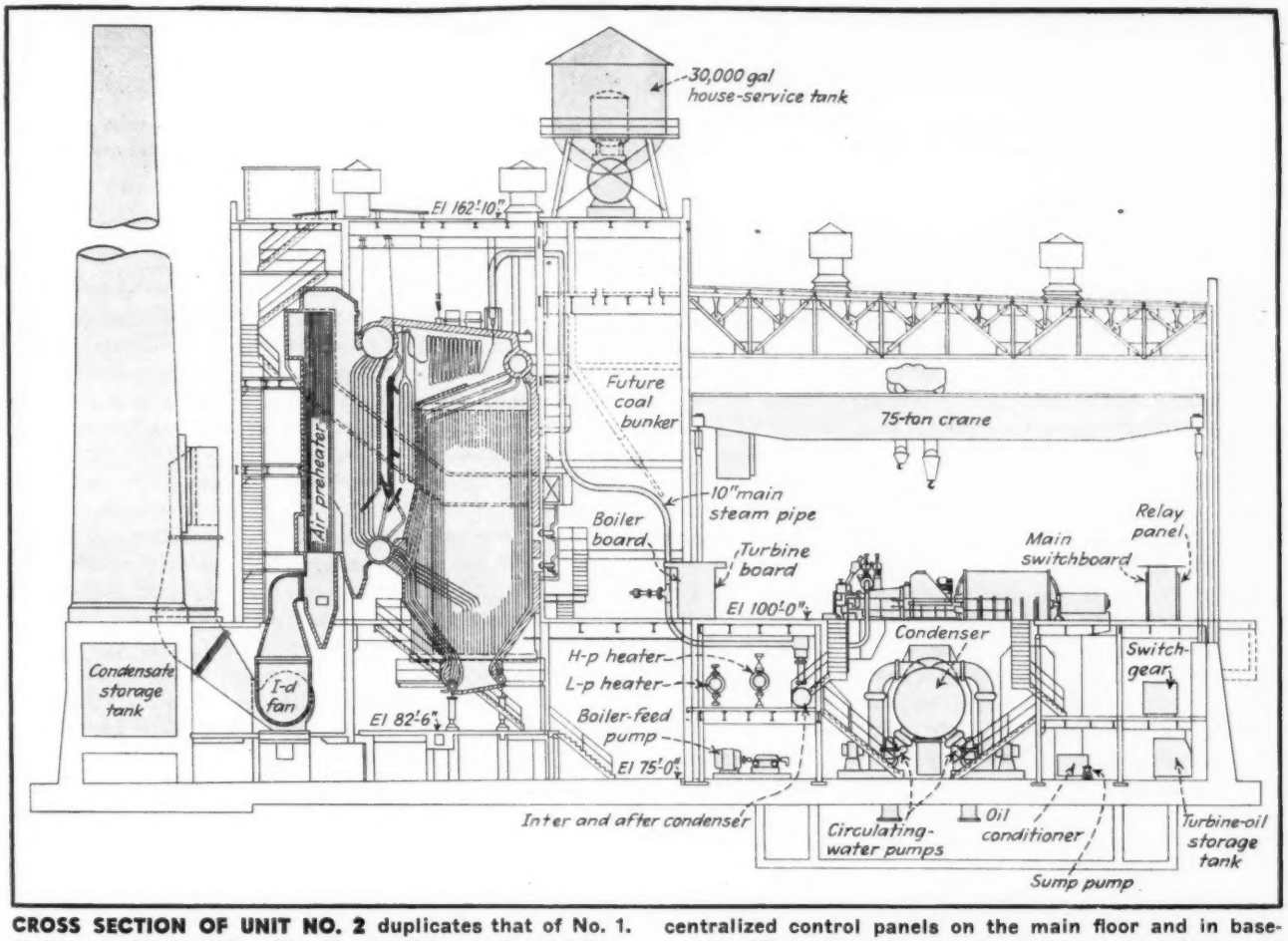
At present the boilers are fired with natural gas, using oil as a standby fuel, which may be burned simultaneously with the gas. Each boiler has six combination gas and oil burners. The entire design allows for possible future use of pulverized coal. Room is provided to install pulverizers, feeders, bunkers and coal-handling equipment without disturbing any equipment. Burner locations, furnace openings and wind-box are all designed to permit replacement of present burners with coal burners without major changes. Hopper bottoms in the boilers will allow dry-ash removal.

The 13,400-cu-ft furnace has a maximum heat-release rate of 22,300 Btu per cu ft per hr burning natural gas, and 21,600 Btu burning coal. No economizer is provided in the units, maximum over-all efficiency with gas being 82.4%. Heat-transfer surfaces in the steam generator are: boiler, 11,700 sq ft; superheater, 9550 sq ft; waterwalls, 7855 sq ft; tubular air heater, 31,500 sq ft.

One f-d and one i-d fan serve each boiler. Each fan has two separate motors for its drive, giving it two different speeds according to which motor is driving. The f-d fan delivers 77,500 cfm of 100-F air against 12-in. static pressure when driven at 1180 rpm by the larger motor. The small motor drives it at 875 rpm. Vanes control air flow.

The i-d fan delivers 140,000 cfm of 425-F gas developing a 12-in. draft

Capacity of Plant Eaton to 45,000 Kw



CROSS SECTION OF UNIT NO. 2 duplicates that of No. 1. Units are side by side with all operations performed from centralized control panels on the main floor and in basement. All equipment excepting the deaerator is housed

when driven by the large motor at 705 rpm; the small motor turns at 500 rpm. This fan has inlet-louver control.

Controls. Automatic feedwater regulator can pass a maximum of 250,000 lb per hr of water at 390 F with maximum pressure drop of 50 psi. The valve maintains a constant water level with varying flows and with differential pressures across the valve varying between 50 psi minimum and 300 psi maximum. A feedwater regulator station with a large gear-operated bypass valve provides manual control of water level. A small 1½-in. bypass can be used for starting up and emergency light-load operation, though experience indicates the automatic valve maintains level at all loads. Locating the feedwater regulator adjacent to the boiler-room control board helps centralize all the operating positions at one point.

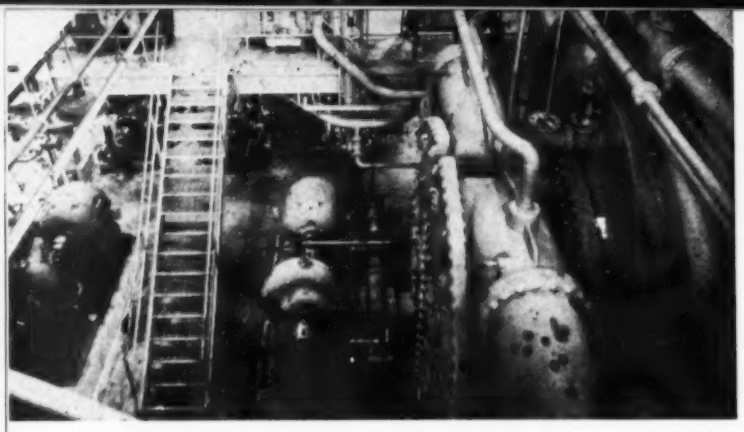
Three separate indicators show the water level: (1) recorder (2) remote indicator on the boiler control board (3) remote indicating mirror system, which can be seen from the regulating valve.

The Republic Flow Meters combustion control uses oil for the power medium and air for the control medium. It automatically controls fuel and air flows and furnace pressure, whether burning gas and oil separately, or in combination. Safety devices limit minimum and maximum fuel supply, and cut off fuel if the draft system fails.

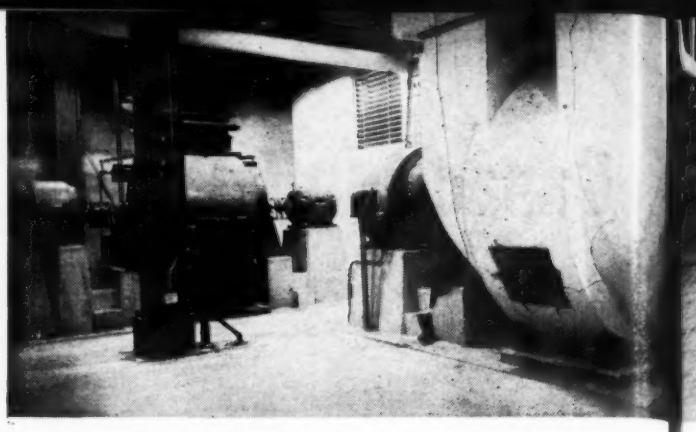
Turbine-Generator. The 22,500-kw General Electric turbine uses steam at 850 psig and 900 F, exhausting it at 2-in. Hg abs backpressure. It is a single-casing single-flow design and has four bleed points, only three being used in the station feedwater cycle. Generator operates at 3600 rpm, 12,000 v, 0.9 pf, 3 phase, 60 cycle, and is hydrogen cooled. The field is energized by a direct-connected exciter and pilot exciter. A motor-operated turning gear is provided for starting and stopping operations.

Main Condenser. Turbine exhausts to a 20,350-sq-ft 2-pass divided water-box surface condenser. This C H Wheeler Manufacturing unit has a welded steel construction, Muntz metal tube sheets and Admiralty metal tubes. Tubes are rolled at one end and packed at the other. Serving this condenser are two cooling-water pumps, each with a capacity of 13,000 gpm against 25.5-ft head, driven by 100-hp motors.

Two condensate pumps, one a spare,



UNIT NO. 2 MAIN CONDENSER with one of its cooling water pumps. The steam-jet air ejectors are on platform



BOILER FANS are in basement. The two fans, f-d (left) and i-d (right), are each driven by two single-speed motors

have a capacity of 400 gpm each against a net head of 330 ft, and are driven by 75-hp constant-speed motors. Recirculation of condensate to the hotwell maintains water level and provides cooling water for the inter- and after-condensers during startup.

Feedwater Cycle. Condensate flows from the hotwell through the inter- and after-condensers of the air ejector, through the closed 1-p heater, and discharges into the deaerating heater. This heater is located on the roof to give maximum head on the boiler-feed-pump suction. From the deaerator storage tank, water flows through the feed pump into the closed h-p heater and then discharges into the boiler.

Closed heaters are horizontally mounted. The 4-pass 1-p heaters have 765 sq ft of heat-transfer surface. The shell can withstand 50 psi, and the water circuit is designed for 250 psi. The 2-pass h-p heaters have 880 sq ft of surface with the shell designed for 350 psi and the tubes for 1400 psi. The vertical deaerating heater has a vent condenser and a horizontal tank with 50,000-lb water-storage capacity. It is designed for 100 psi and guaranteed to maintain not more than 0.003 cc per liter of oxygen content in the effluent.

An evaporator delivers makeup to the cycle. It has a rated capacity of 7500 lb per hr of vapor. This unit, with an effective heating surface of 147 sq ft, gets preheated and deaerated water at 210 F from a deaerating heater. Evaporator steam circuit is designed for 350 psi and the welded shell for 100 psi.

The two main units have three boiler feed pumps, one acting as a spare for either unit. Each has a capacity of 550 gpm of 310-F water with a net head of 2490 ft. All pumps are driven directly by 450-hp motors at 3600 rpm. Each pump has a bypass for use during starting; water discharges to the deaerator storage tank. The bypass control valve normally remains closed after the pump flow reaches a value that keeps the pump cool. The operator can quickly open this manually operated valve, located beside the boiler control board, if pump discharge should be suddenly reduced.

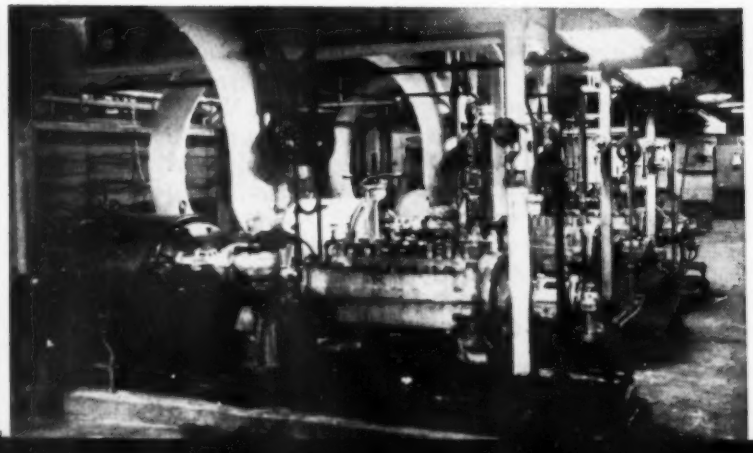
The h-p heater drains discharge to the 1-p heater during starting periods and light loads. When the pressure differential between h-p heater and deaerating heater exceeds the static pressure, these drains automatically shift from the 1-p heater to the deaerator. A pump handles the 1-p heater drainage, discharging it into the condensate line leaving this unit. In emergency all heater drains can be discharged manually into the condenser.

Auxiliary Supply. Station - service power is distributed at 2300, 575 and 208 v. Motors are connected to these three systems according to size: (1) motors rated 100 hp and above are served at 2300 v (2) motors between 2 and 100 hp connect to the 575-v system (3) motors less than 2 hp and lighting are supplied at 208 v. Use of these three voltage levels is found to be most economical.

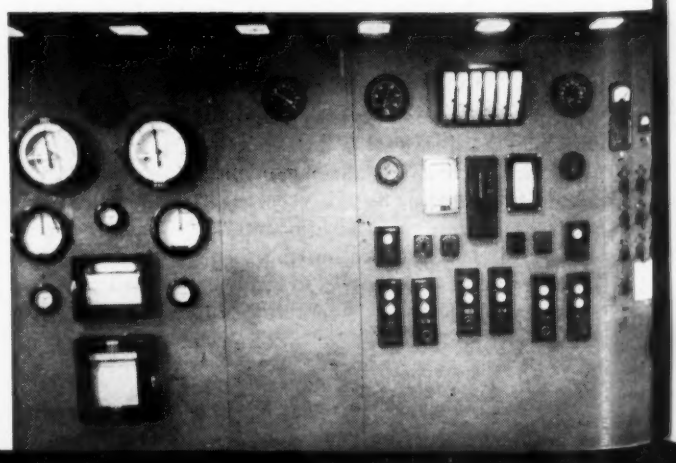
Air circuit breakers serve on all three systems. The vertical-lift 2300-v breakers have an interrupting rating of 50,000 kva. Bus and all connections in the 2300-v switchgear compartments are insulated for full operating voltage. Vertical-lift breakers have an inherent clearance position. By lowering a breaker to floor level, clearance can be obtained for maintenance work on the outgoing circuit without removing the breaker from its compartment.

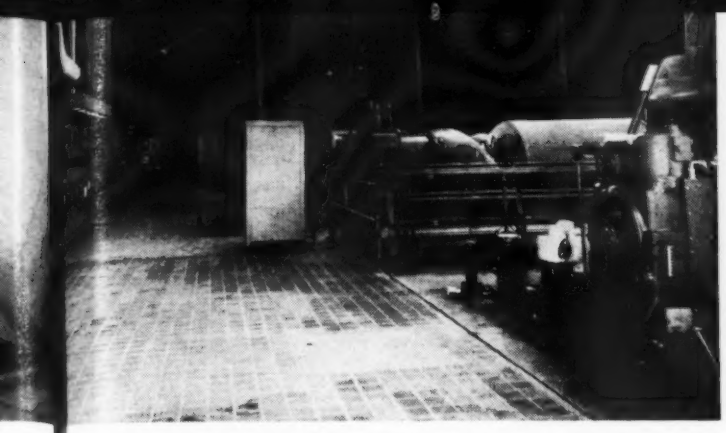
The 575-v switchgear, designed for

BOILER FEED PUMPS for units No. 1 and 2 are driven by single-speed motors, have bypasses for starting-up period

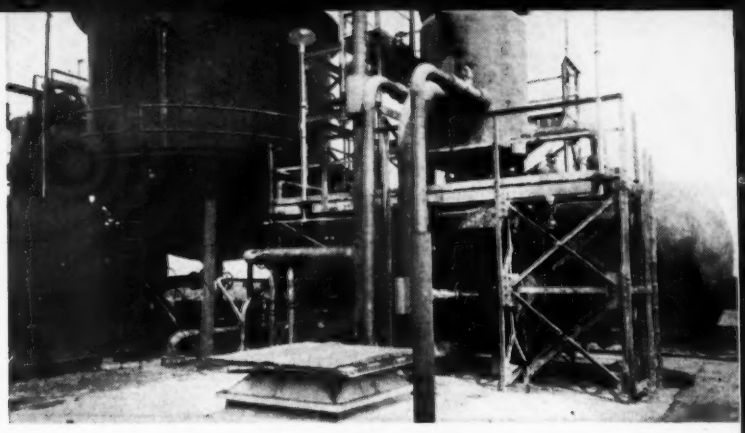


BOILER CONTROL PANEL, back-to-back with turbine control panel, centralizes boiler operation on main floor





TURBINE-ROOM FLOOR with No. 1 in background and No. 2 at right. Boilers behind turbine-control panel at left



DEAERATING HEATER AND STORAGE TANK, the only outdoor heat-power equipment, are inspected once a watch

stresses from a maximum short circuit of 15,000 amp, is also totally inclosed in steel compartments. Spacing of buses and connections did not warrant insulating these parts within the compartments. This switchgear is split into two groups to simplify the conduit layouts. One is in the turbine room and the other in the boiler room. Each breaker, withdrawal type, is provided with a test position in which it disconnects and remains within its compartment. A clearance position is also provided in which the breaker can be locked and remain in its compartment.

To prevent any ground fault on the large motors from developing into a phase-to-phase fault, it was decided to connect the 2300-v system wye and operate it grounded. Induction 40-second overcurrent relays and induction ground relays protect the 2300-v motor circuits.

The 575-v system is wye connected, but for economy is being operated ungrounded. Outgoing circuits are protected with thermal magnetic trip devices built into the breakers. Main supply circuits are protected with induction overcurrent relays.

General Features. Indoor inclosed electrical equipment and large motors are protected against high humidity. Electric heaters have been provided in all cubicles of the switchgear and in the outlets of all large motors. All motors are completely dripproof.

Unbalanced fans are the usual cause of excessive vibration in modern plants. Here the fans are supported directly on the base slab, which makes it almost impossible to transmit any vibration to the building. For this reason it has not been necessary to make any special provisions against excessive vibrations on the main switchboard and the station-service switchgear.

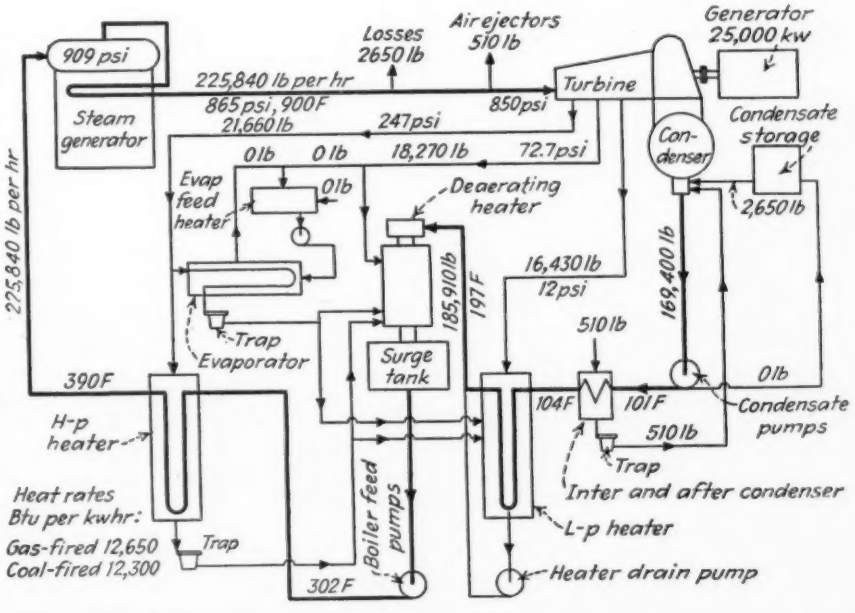
A completely automatic telephone system provides intra-plant communication. This is supplemented by an automatic code-call system operated through the dials on the telephones for calling any members of the operating personnel. All major telephones have soundproof booths provided.

Because of the major importance of Plant Eaton in maintaining service on the Mississippi Power Co system and the small margin between ground elevation and floodwater levels, a dike around the entire plant was deemed essential. The dike is now under construction and partly completed. Top of this bulkhead at elevation 105 is calculated to withstand a flood occurring only once in every 500 years.

The entire building has induced ventilation designed to change the air completely every three minutes. No window sash is provided above a level of about 10 ft from the operating floor, the openings being closed by glass brick. There are twenty 48-in. ventilators with propellor fans in the roof, drawing air out of the building and discharging it to atmosphere. Thus all air flows into the building at the operating level providing maximum air movement. If the window sashes are closed air can be induced to flow into the basement through areaways provided at intervals, and then up through the building.

The net heat rate for Plant Eaton during the year 1946 was 12,800 Btu per kwhr. More efficient stations may have been designed at this pressure and temperature level, but for the cheap fuel here, economics did not warrant using more than three bleed points and dictated elimination of an economizer.

Plant design was guided to a great extent toward minimizing the number



HEAT-BALANCE LAYOUT reflects influence of low-cost gas fuel, uses three heaters and no economizer in steam generator. Gas bypass controls superheat

of operating personnel needed. All rotating equipment and control points are kept to the boiler- and turbine-room floor and the basement. No operator need go above these levels to perform any duties, except for an inspection of the deaerator on the roof about once a watch. Only seven operators are needed to run the two units on any shift.

Three single-phase oil-immersed transformers comprise the main bank of each unit. Each has a self-cooled rating of 7500 kva and forced-air-cooled rating of 10,000 kva. Voltage rating is 11,500/110,000, generator to transmission line.

The station-service transformer of each unit is a 3-phase, 3-winding oil-immersed unit. High-voltage winding is rated at 2000 kva at 12,000 v, the 2300-v winding rated 1600 kva and 575-v winding rated 667 kva, all self cooled.

PRINCIPAL POWER-PLANT EQUIPMENT

Plant Eaton, Mississippi Power Co

TURBINE-GENERATORS, UNITS 1 AND 2:

Turbine-generator ..... General Electric Co
22,500 kw, 850 psig, 900 F, 2-in. Hg abs exhaust, 4 bleed points, single casing, single flow, 3600 rpm, 0.9 pf, 12,000 v, 3 phase, 60 cycle. Main exciter, direct connected, 100 kw, 250 v. Pilot exciter, 4 kw, direct connected, 250 v. Hydrogen cooled.
Turbine oil filter, 540 gph ..... Bowser Inc
Condenser ..... C H Wheeler Manufacturing Co
Two pass, divided water box, surface type, 20,350 sq ft, Muntzmetal tube sheets, Admiralty metal tubes.
Condenser cooling-water pumps, 2 ..... C H Wheeler Manufacturing Co
13,000 gpm each, 430 rpm, motor driven, 100 hp, 2300 v.
Air ejectors, 2 stage, tube jet ..... C H Wheeler Manufacturing Co
Priming ejectors, 4-in. tube jet ..... C H Wheeler Manufacturing Co

STEAM-GENERATING EQUIPMENT, UNITS 1 AND 2:

Boiler ..... Riley Stoker Corp
230,000 lb per hr, 11,700 sq ft, 975 psi (design), three drum.
Superheater, high velocity ..... Riley Stoker Corp
Convection inter-bank, 9550 sq ft, 900 F, 875 psi, bypass control.
Furnace ..... Riley Stoker Corp
Tangent tube, 13,400 cu ft, 7855-sq-ft waterwall surface, provision for Allen-Sherman-Hoff furnace bottom.
Air preheater, 31,500 sq ft, tubular ..... Riley Stoker Corp
Forced-draft fan ..... American Blower Corp
77,500 cfm at 1180 rpm, 57,500 cfm at 875 rpm, two-motor drive, 200 hp, 2300 v, and 75 hp, 575 v.
Induced-draft fan ..... American Blower Corp
140,000 cfm at 705 rpm, 99,000 cfm at 500 rpm, 2-motor drive, 450 hp, 2300 v and 150 hp, 2300 v.
Blowoff valves, sets 1½-in. unit tandem type ..... Yarnall-Waring Co
Water columns, 2, ... Reliance Gauge Column Co / Diamond Power Specialty Corp
Safety valves ..... Manning, Maxwell & Moore Co
Soot blowers ..... Diamond Power Specialty Corp
Burners, 6 per boiler, gas and oil (Coppus-Dennis) ..... Coppus Co
Combustion control system ..... Republic Flow Meters Co
Duct work ..... Connery Construction Co

CONDENSATE AND FEEDWATER SYSTEM, UNITS 1 AND 2:

Condensate pumps, 2 ..... C H Wheeler Manufacturing Co
Three stage, 550 gpm, 1150 rpm, motor driven, 75 hp, 575 v.
Boiler feed pumps, 3 (for 2 units) ..... Ingersoll-Rand Co
575 gpm, 2490-ft head, 3550 rpm, 8 stages, motor driven, 450 hp, 2300 v.
Feedwater heater, 7th stage ..... Foster-Wheeler Corp
880 sq ft, horizontal, two pass, 1400-psi water, 350-psi steam.
Feedwater heater, 12th stage ..... Elliott Co
Vertical deaerating, 250,000 lb per hr, 100 psi, 50,000-lb storage tank.
Feedwater heater, 16th stage ..... Elliott Co
765 sq ft, horizontal four pass, 250-psi water, 50-psi steam.
Evaporator ..... Griscom-Russell Co
7500 lb per hr net, single effect, bent tube, 350-psi steam, 100-psi vapor.
Evaporator feed heater ..... Elliott Co
7500 lb per hr, 15 psi, vertical deaerating type.
Feedwater regulator, oil operated ..... Republic Flow Meters Co
Heater drain pump ..... Worthington Pump & Machinery Corp
40 gpm, 2 stage, 300-ft head, 3480 rpm, motor driven, 15 hp, 575 v.
Evaporator feed pumps, 2 ..... Ingersoll-Rand Co
20 gpm, 2 stage, 255-ft head, 3450 rpm, motor driven, 5 hp, 575 v.
Heater drains and level controllers ..... Fisher Governor Co
Combustion control oil pumps, 2 ..... Worthington Pump & Machinery Corp
38 gpm, rotary gear, 100 psi, 1150 rpm, motor driven, 5 hp, 575 v.

PIPING, VALVES AND FITTINGS, UNITS 1 AND 2:

General piping contractor ..... Grinnell Co, Inc
H-p piping (fabrication only) ..... National Valve & Manufacturing Co
Insulation contractor ..... Philip Carey Manufacturing Co
Gate and globe valves ..... The Chapman Valve Manufacturing Co / Lunkenheimer Co
Small h-p globe valves ..... Manning, Maxwell & Moore, Inc
Check valves ..... The Chapman Valve Manufacturing Co
Stop-check valve ..... Lunkenheimer Co
Miscellaneous valves ..... Atwood & Morrill Co / Crane Co / Fisher Governor Co / Hagan Corp / Merco-Nordstrom Valve Co / Henry Vogt Machine Co
Steam traps ..... Armstrong Machine Works

INSTRUMENTS:

Draft gages ..... Republic Flow Meters Co
Flowmeters ..... Republic Flow Meters Co
Pressure gages, indicating ..... Manning, Maxwell & Moore, Inc
Pressure gages, recording ..... Republic Flow Meters Co
Indicating thermometers ..... Taylor Instrument Co
Recording thermocouples ..... Leeds & Northrup Co
Conductivity recorders ..... Leeds & Northrup Co
Boiler-water-level recorder ..... Republic Flow Meters Co
CO_2 recorder ..... Leeds & Northrup Co
Liquid-level indicators ..... The Foxboro Co
Instrument boards ..... Clement Industrial Electric Co

ELECTRICAL EQUIPMENT, UNITS 1 AND 2:

Main transformers ..... General Electric Co
11,500 delta/110,000 wye, 3 single phase, 7500 kva each, self-cooled, 10,000 kva each, forced air-cooled.
Station-service transformer ..... Westinghouse Electric Corp
3 phase, 2000 kva self-cooled, 2500 kva forced air-cooled.
12,000 delta/2300 wye-575 wye
115-kv oil circuit breaker ..... Westinghouse Electric Corp
15-kv disconnecting switches ..... Delta-Star Electric Co
115-kv disconnecting switches ..... Johnson Manufacturing Co
Switchyard structures ..... Lehigh Structural Steel Co
Power and control cables ..... Okonite Co
2300-v station-service switchgear ..... General Electric Co
Metalclad, 2500 v, 600 amp, 50,000-kva interrupting capacity.
575-v station-service switchgear ..... I-T-E Circuit Breaker Co
Air circuit breakers, steel inclosed, 15,000-amp interrupting capacity.
208-v station service switchgear ..... Westinghouse Electric Corp
Motors ..... General Electric Co
Generator neutral reactor ..... General Electric Co
Main control switchboard ..... Clement Industrial Electric Co
Lighting equipment ..... Westinghouse Electric Corp
Storage battery ..... Electric Storage Battery Co

MISCELLANEOUS, UNITS 1 AND 2:

Traveling water screens, 2, 30,000 gpm ..... Link-Belt Co
Turbine-room crane ..... Shaw-Box Crane & Hoist
Main hook 75 tons, auxiliary hook 15 tons, 80-ft span, 60-ft lift.
Boiler-room hoist, 10 tons, 80-ft lift ..... Robbins & Myers, Inc
House-service tank, 30,000 gal ..... The Steel Construction Co
Clear-water tank, 7500 gal ..... The Steel Construction Co
House-service pumps, 2 ..... Ingersoll-Rand Co
1000 gpm, 175-ft head, 1750 rpm, motor driven, 60 hp, 575 v.
Cooling-water pump ..... Ingersoll-Rand Co
600 gpm, 70-ft head, 1745 rpm, motor driven, 15 hp, 575 v.
Sump pumps, 2 ..... Yeomans Brothers Co
300 gpm, 42-ft head, 1750 rpm, motor driven, 5 hp, 575 v.
Chemical feed pump ..... Worthington Pump & Machinery Corp
1½ gpm, 1250 psi, 205 rpm, motor driven, 2 hp, 208 v.
Service air compressor ..... Chicago Pneumatic Tool Co
305 cfm at 100 psi, 300 rpm, receiver, air filter, aftercooler.
V-belt, water-control valve, motor driven, 60 hp, 575 v.
Control air compressor ..... Chicago Pneumatic Tool Co
111 cfm at 100 psi, 325 rpm, receiver, air filter, aftercooler.
V-belt, water-control valve, motor driven, 25 hp, 575 v.
Radial brick chimney ..... Alphons Custodis Chimney Construction Co
Deepwell pump, 250 gpm ..... Layne-Central Co

HORACE W WILDS

Developed his liking for power as a marine man, then entered the stationary field. By study and applied experience he progressed from operation to supervision, administration

BILL WILDS believes in long-range planning to fit outside study and self-improvement into a well-crowded schedule

▶ TO GET AHEAD in the power field a man must study himself first and then his job—if either seems lacking, then get moving. That's a working creed Horace William Wilds, building manager for the New York Life Insurance Co, has used throughout his life.

Born and raised near Geronimo, Arizona, Bill picked up his schooling inside and outside the classroom. A large part of those early days was spent with ranch hands and mule skinners, who taught him how to use his hands. School seemed too confining, and he developed an itch to see the world. So at the advanced age of 17 he set out and arrived in El Paso, Texas, where he became fully sold by the Navy's advertising slogan, "See the world with the U. S. Navy." He signed up for a 4-year hitch.

The U. S. Navy gave expression to his mechanical leanings. He served first as fireman, and then as engine man with the "black gang," and in these surroundings developed a liking for power engineering that has stayed with him. When World War I struck in 1917, he shipped out in American and European waters as a seasoned Navy veteran, hitting practically every port along our east and west coasts, as well as several in Europe and South America.

With his discharge in 1919 Wilds entered the merchant marine where he served as engineer for two years. Then he came ashore for good.

Bill accepted an engineer's job with the old Rutledge Hotel in New York City, and later went with the City of New York as watch engineer for the Water Department. Through all these shifts he kept an eye out for self-improvement. He also wanted experience in all kinds of power plants from the smallest to the largest. To gain this background he went to work as a boiler inspector for an insurance company. Incidentally, this experience led to his appointment in 1941 to represent the owners and users of power boilers on the New York State Board of Examiners for Boiler Inspectors, a post that he still holds.

But Wilds missed operating and went back to it as an engineer with the old Park Avenue Hotel. Soon he moved on to the Roosevelt Hotel, first as watch engineer, then first assistant, and finally chief engineer.

In 1928 Bill accepted the post of chief engineer and assistant building manager of the New York Life Building. He rose to his present position of building manager, with all building functions, power included, immediately under his direction. This involves supervising a total of about 400 people.

OUTSIDE STUDY PROGRAM

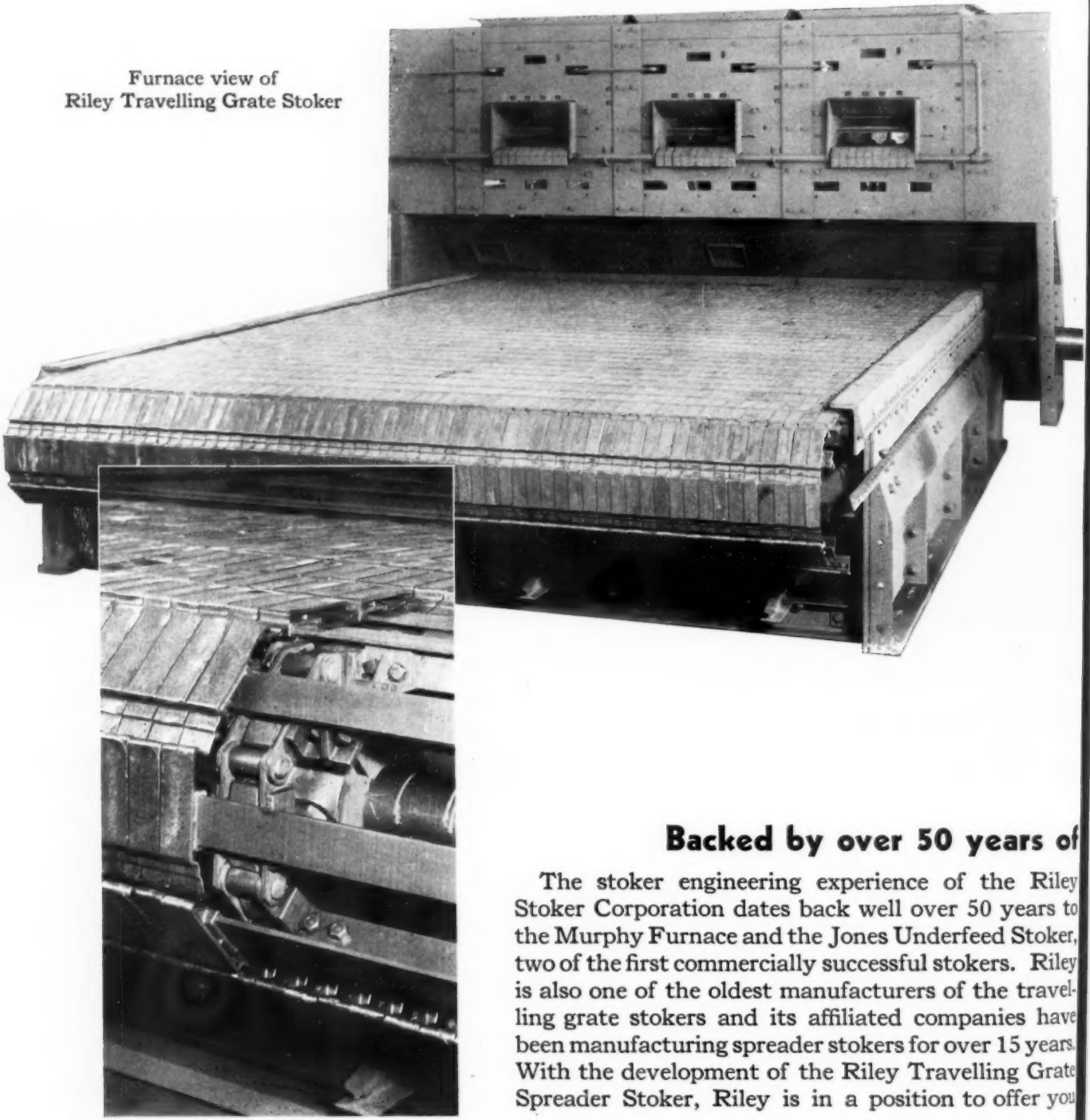
Early in his stationary experience he joined the old National Association of Steam Engineers, now the National Association of Power Engineers, to supplement his outside study. Over a period of years that program of self-improvement had ranged from U. S. Navy training courses to special ones in accounting, law, steam engineering and mechanical drafting, given at Columbia University, Pratt Institute and the New York School of Commerce.

Fitting NAPE into his crowded schedule required long-range planning. Bill recalls the night that his boss relieved him on a 12-hr shift so that he could be initiated. But as time went on he took an increasingly active part in NAPE affairs. He has been president of New York 1, state deputy for New York, a member of the national board of trustees, national vice-president, and in 1936-37 national president. He continues highly active in local and national affairs of the association as well as with civic and real estate groups.

Wilds strongly believes in helping younger men. He feels, though, that moving up the ladder depends largely on the individual. If a young man is blessed with ambition he'll be ready for the next job before it breaks. Such a man, Bill thinks, can be put in a responsible spot with every confidence that he will grow into it.

Investigate the RILEY

Furnace view of
Riley Travelling Grate Stoker



Backed by over 50 years of

The stoker engineering experience of the Riley Stoker Corporation dates back well over 50 years to the Murphy Furnace and the Jones Underfeed Stoker, two of the first commercially successful stokers. Riley is also one of the oldest manufacturers of the travelling grate stokers and its affiliated companies have been manufacturing spreader stokers for over 15 years. With the development of the Riley Travelling Grate Spreader Stoker, Riley is in a position to offer you

TRADE MARK Rx REGISTERED

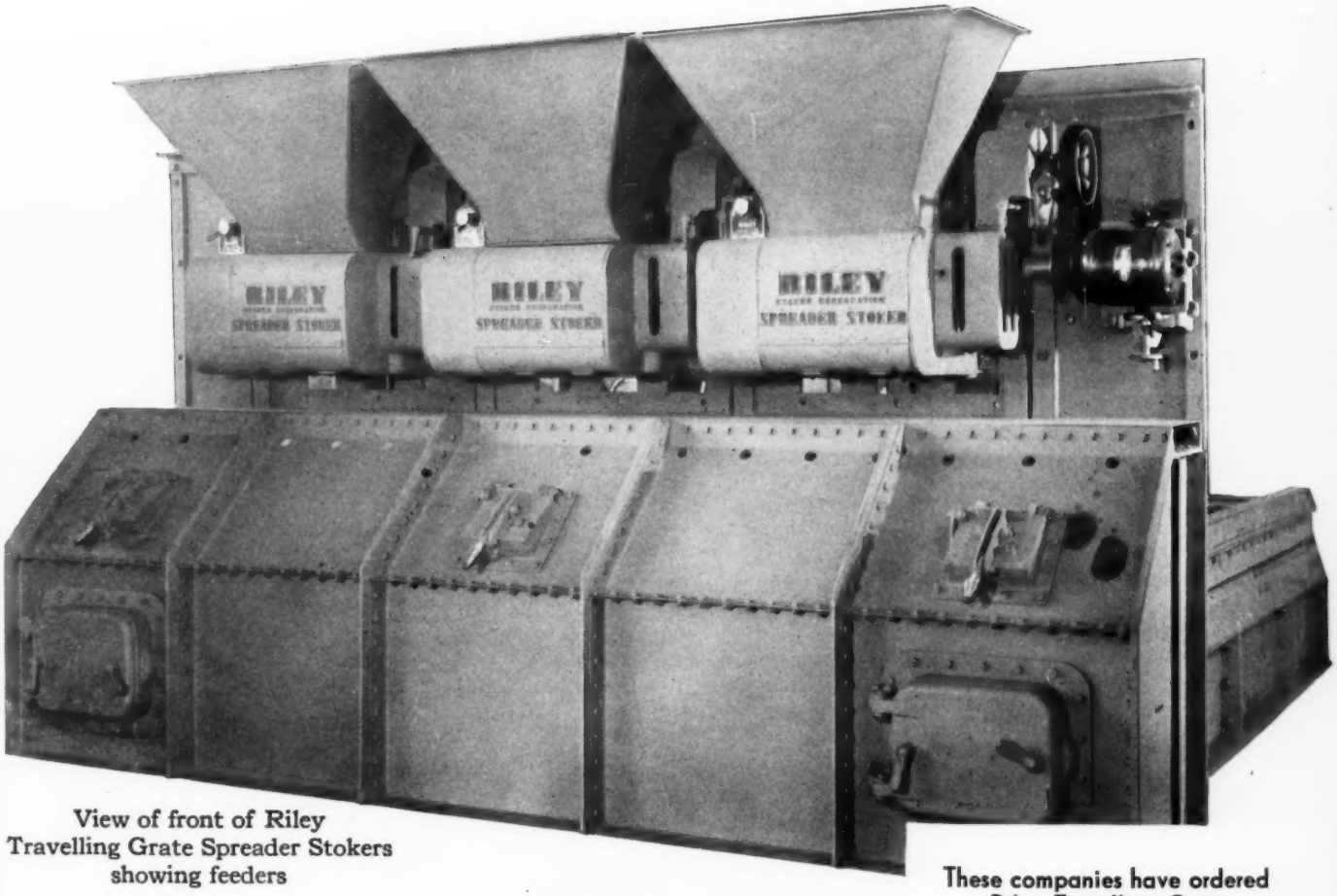
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul
Pittsburgh Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

traveling grate spreader stoker



View of front of Riley Travelling Grate Spreader Stokers showing feeders

stoker manufacturing experience

any and all types of coal burning equipment, including all types of stokers and two types of coal pulverizers.

Your investigation of Riley Travelling Grate Spreader Stokers will indicate to you the many distinctive advantages in construction and operation resulting from the extensive experience of the Riley Stoker Corporation. We believe you will agree that the Riley Travelling Grate Stoker is the outstanding stoker of this type. It will pay you to keep your eye on Riley in the spreader stoker field. Riley users will tell you, "you can rely on Riley."

These companies have ordered Riley Travelling Grate Spreader Stokers

COMMONWEALTH & SOUTHERN CORP.
for Ohio Edison Co., Akron, Ohio
2—16'0" x 15'0"; 2—90,000 lbs./hr. units

CITY OF PROVO, UTAH
1—16'0" x 17'0"; 1—100,000 lbs./hr. unit

COMMONWEALTH & SOUTHERN CORP.
for Central Illinois Light Co., Springfield, Ill.
1—20'0" x 17'0"; 1—150,000 lbs./hr. unit

SWIFT & CO., E. St. Louis, Ill.
1—14'0" x 15'0"; 1—75,000 lbs./hr. unit

UTICA KNITTING CO., Utica, N. Y.
2—11'0" x 15'0"; 2—50,000 lbs./hr. units

CELANESE CORP. OF AMERICA, Hopewell, Va.
1—9'0" x 12'0"; 1—40,000 lbs./hr. unit

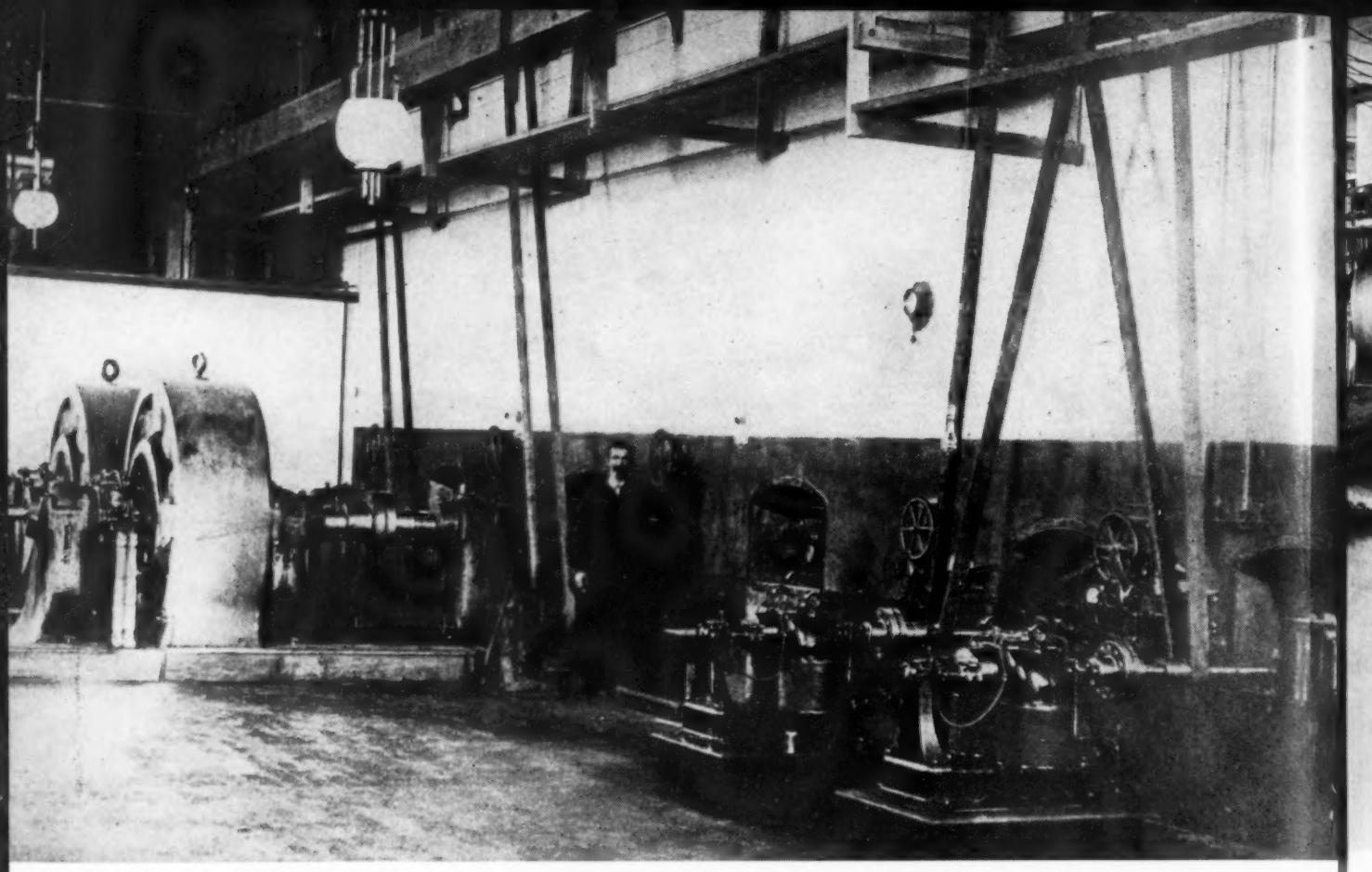
UNIV. OF MINNESOTA, Minneapolis, Minn.
1—13'0" x 17'0"; 1—60,000 lbs./hr. unit.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS



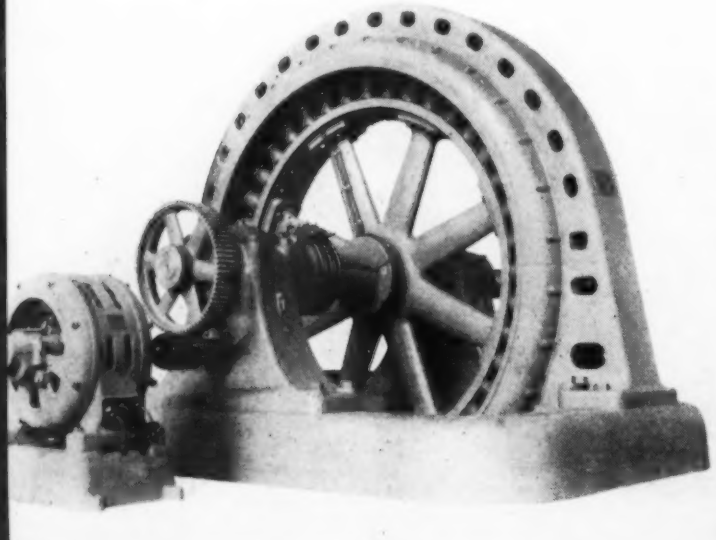
CALIFORNIA GENERATING STATION installed in 1893 had first polyphase transmission system in the U. S. Generators are 250 kw, 2400 v, 3 phase, 600 rpm. Power was transmitted 7½ miles to a 150-hp synchronous motor

Synchronous Motors: Yesterday and Today

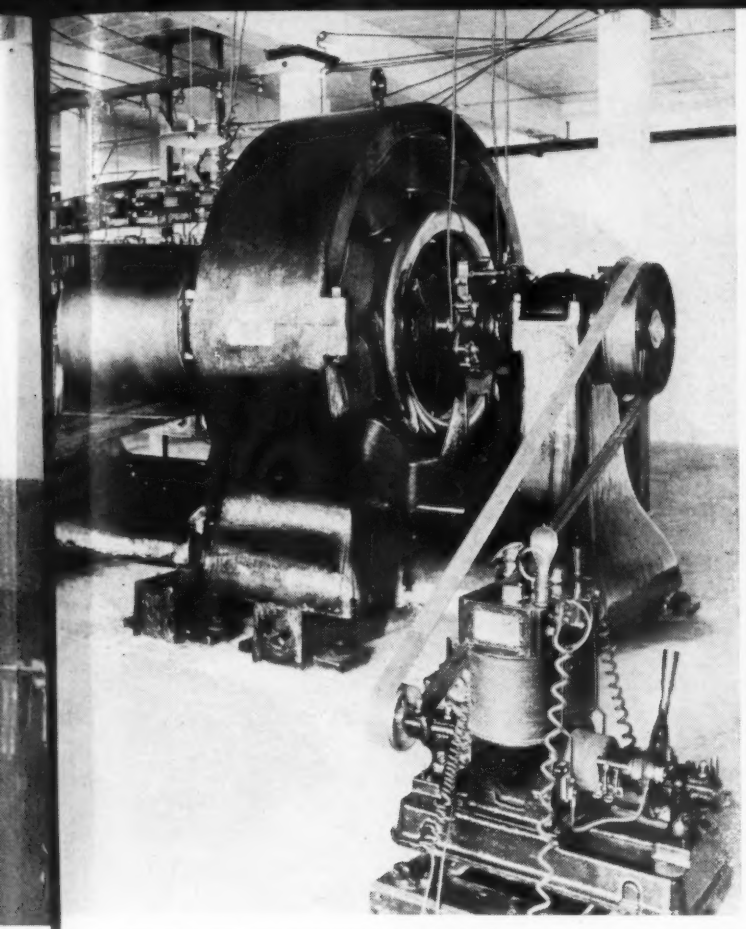
By A G FERRISS, *General Electric Co.*

▶ SYNCHRONOUS MOTORS were a natural outgrowth of ac systems because the first motors were ac generators connected to a load and supplied with ac power. Similarity between the first ac synchronous motor and the present-day dc motor can be readily understood because ac generators and motors were made by replacing the dc commutator with a set of sliprings. For this reason

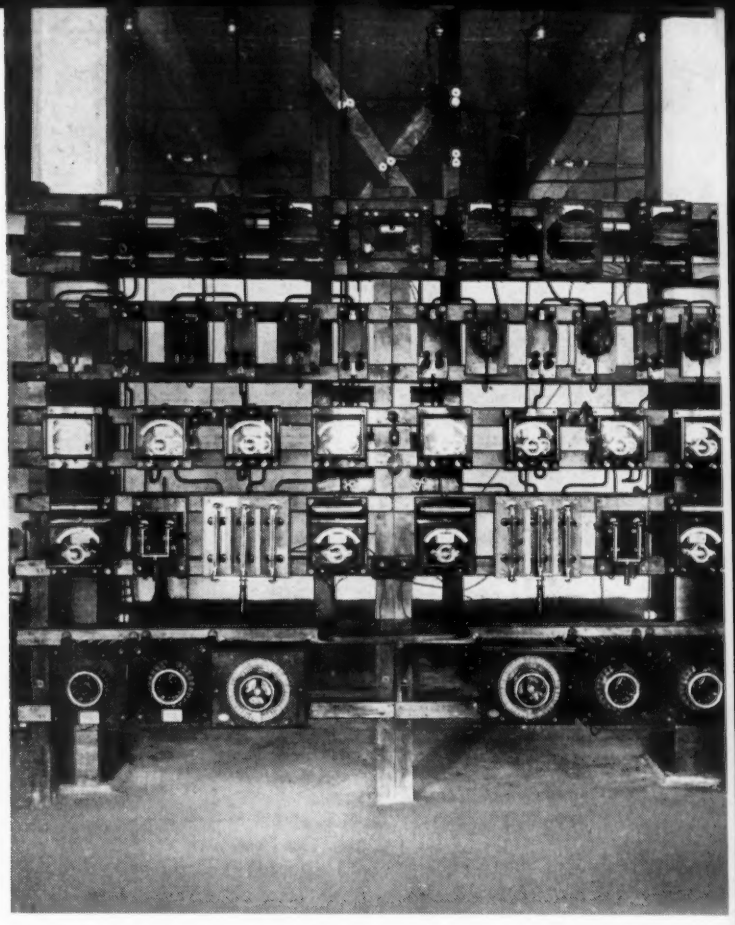
THIS 1900 DESIGN features the revolving-field construction, and uses a separate motor for starting



SIX MOTORS, four vertical and two horizontal, show typical plant installation, made between 1900 and 1915



FIRST SYNCHRONOUS MOTORS had revolving armatures copied from dc machines, as is shown by this 250-hp unit



THIS EARLY SWITCHBOARD was used on synchronous motors and generators. Board shown was installed in 1894

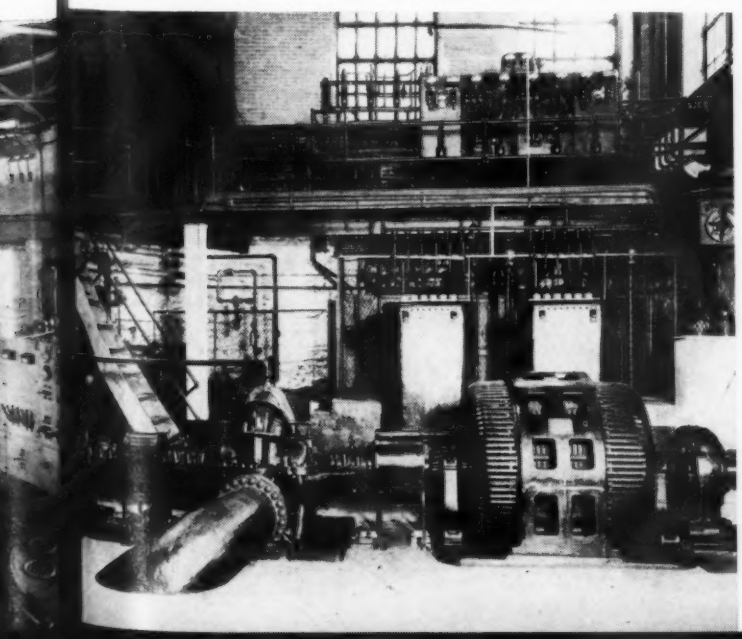
the first ac motors had revolving armatures and stationary fields.

Simpler Construction. About 1900, advantages of the revolving field became evident, so electrical manufacturers changed to this simpler construction. Shortly after they adopted the revolving field, amortisseur windings were used to assist in synchronizing the motor after a starting motor had brought it close to synchronous speed. By 1908 amortisseur windings were used for light starting duty. Their use for moderate starting duty was well advanced by 1927, and they were applied on motors up to 5000 hp.

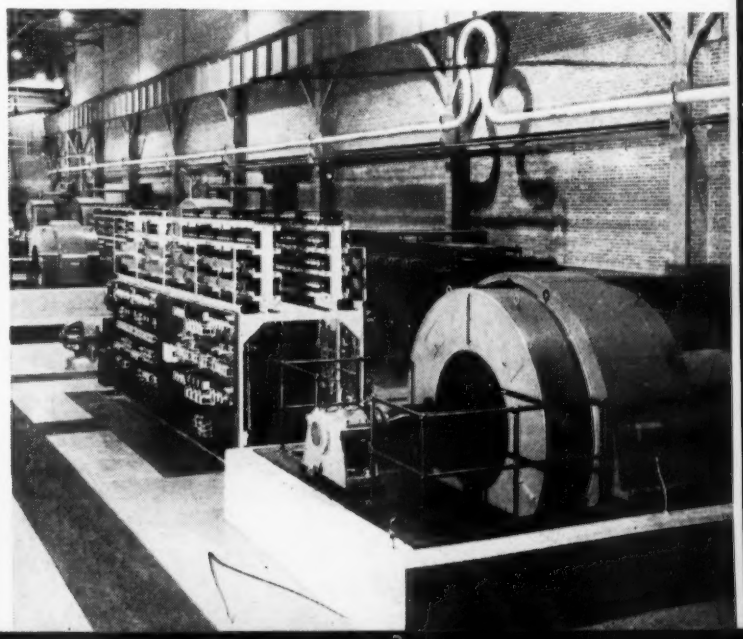
Streamlined Motor. From the time of the first slow-speed revolving-field motor, which resembled a giant engine flywheel, to the present stream-lined motor, emphasis has been on appearance and protection. Thus, as public utilities and industry have become more conscious of the appearance of their equipment, diameters have decreased and machines have become longer. A more inclosed machine has been developed because increased speeds have made safety more important.

(*Continued on page* 102)

HIGH-SPEED SYNCHRONOUS MOTOR of 1650 hp drives two pumps installed in 1925 in a municipal water system



ATTRACTIVE APPEARANCE is typified by these 2500-hp 375-rpm motors installed in a steel mill during 1937



HOW TO AVOID A

Use Armstrong Steam Traps

. . . . they seldom need attention!

Here's evidence of the ability of Armstrong traps to stand up in tough service. Take a look at the crust of scale in the interior of this trap. When inspected it was operating like new. The valve is clean and bright where it contacts the seat showing that it was seating perfectly. The vent in the bucket (where air goes through) is still open.

When you install Armstrong traps you can forget about them for a long time.

The reasons why Armstrong traps stand up so well in service and save engineers a lot of maintenance can be found in the basic design:

INVERTED BUCKET—nothing to collapse or spring a leak.

FREE-FLOATING VALVE—nothing to stick or bind.

SELF-SCRUBBING ACTION—condensate rushes and swirls through the trap carrying away dirt and scale.

CHROME STEEL VALVE AND SEAT—hardened, ground and lapped. Highly resistant to wear. Hemispherical valve seats perfectly in any position.

STAINLESS STEEL INTERIOR—valve lever and bucket assemblies are corrosion-resistant stainless.

Every Armstrong trap is inspected and tested under pressure before it leaves the factory. Trouble-free design plus quality materials plus careful workmanship plus tested performance—that's why Armstrong can guarantee "satisfaction or your money back."

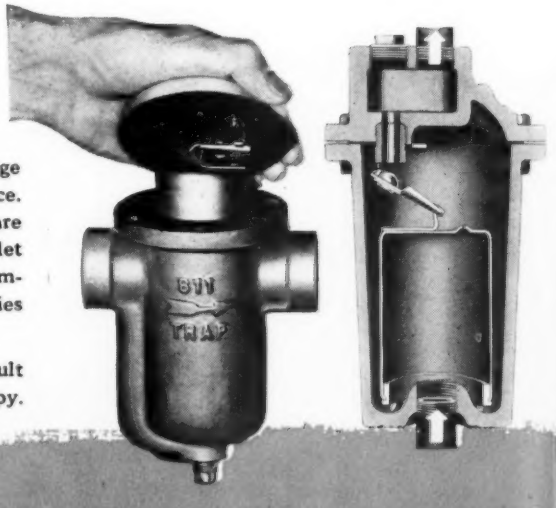
Plan to modernize your trapping with Armstrongs. Call an Armstrong representative or write:

ARMSTRONG MACHINE WORKS
812 Maple St., Three Rivers, Michigan

THE MODERN ARMSTRONG TRAP

Most of the Armstrong traps pictured on the right hand page are old timers—obsolete models—but they are still in service. Modern Armstrong traps are pictured at the right. They are available in side inlet—side outlet and bottom inlet—top outlet models to provide the best possible installations. There is a complete line of Armstrong traps for pressures to 2400 psi., capacities to 300,000 lbs. condensate per hour.

For prices, capacities, selection and installation data consult the 36 page Armstrong Steam Trap Book. Write for a copy.

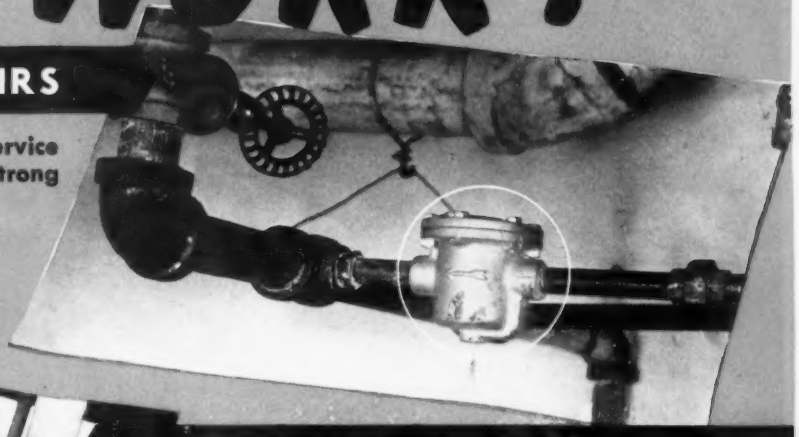


ARMSTRONG *Inverted*

LOT OF WORK!

10 YEARS WITHOUT REPAIRS

36 Armstrong traps on heating system service in an Atlanta building were still going strong without maintenance after 10 years.

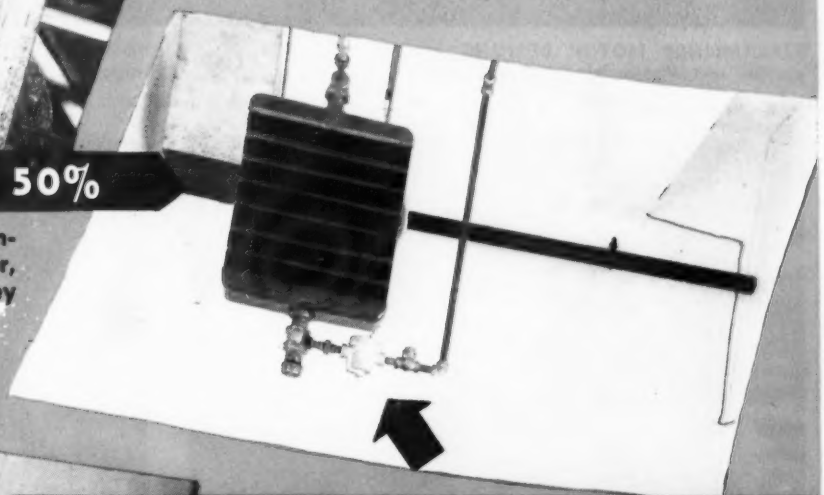


20 YEARS' SERVICE

One minor repair job in twenty years — that's the record of the Armstrong traps shown here. They are in service at a S. Dakota hospital.

MAINTENANCE REDUCED 50%

It only takes half as much time to maintain 300 Armstrong traps at a Rochester, N. Y., photo supply as it did the traps they replaced.



10 YEARS—NOT A CENT FOR REPAIRS

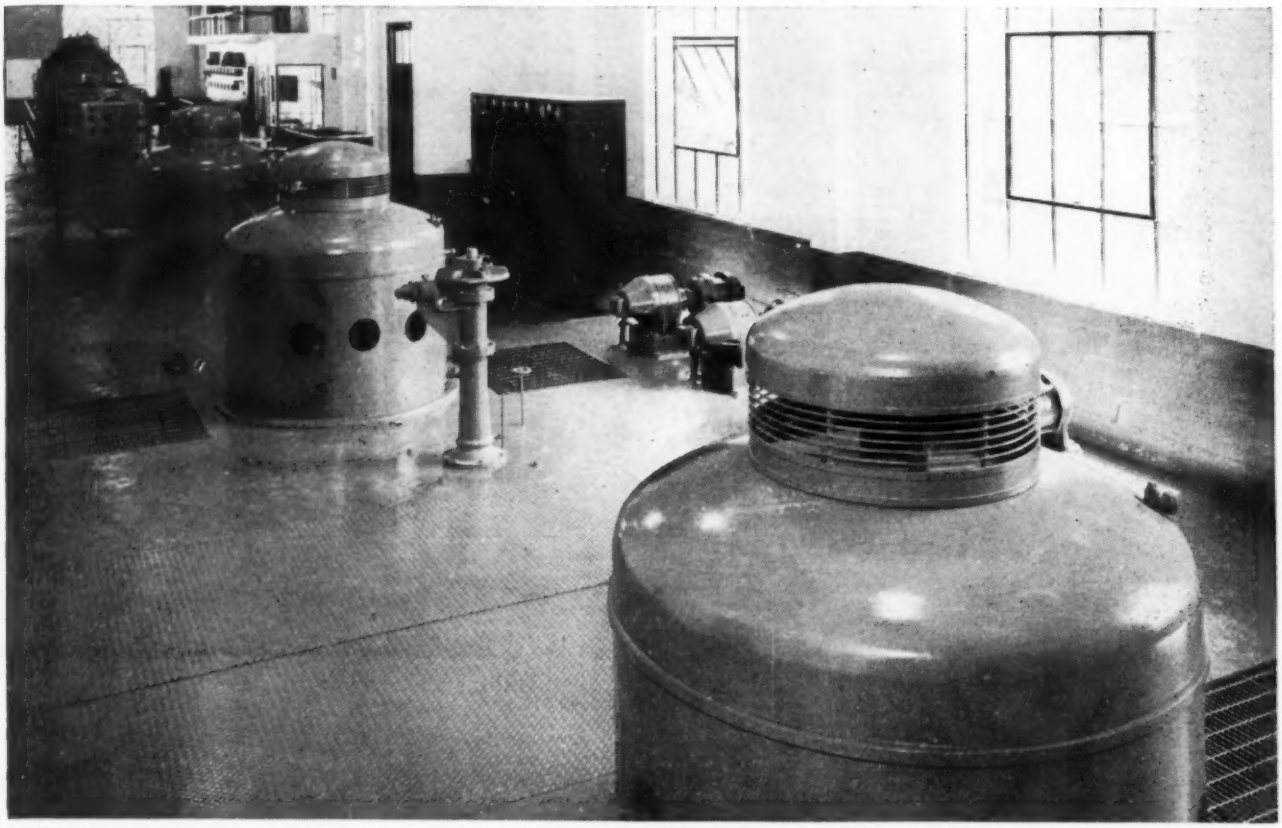
These traps on a milk drier delivered perfect performance for 10 years with their original parts.

SEE OUR CATALOG IN SWEET'S

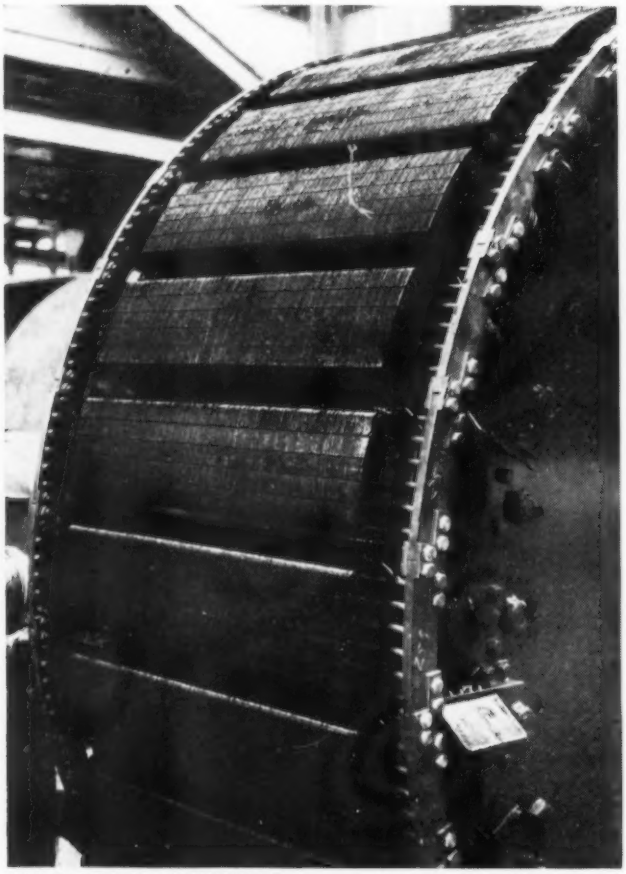
ARMSTRONG "INVERTED BUCKET" STEAM TRAP

Bucket STEAM TRAPS

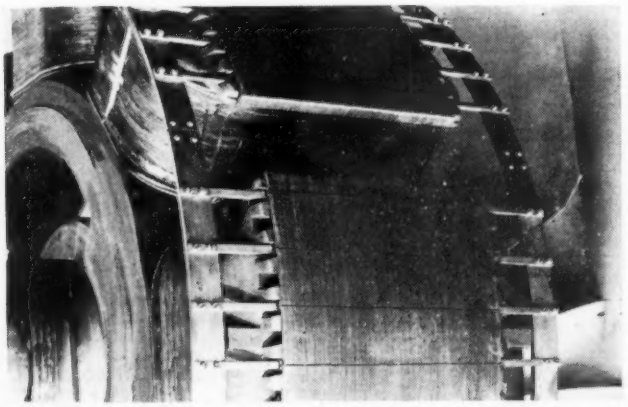
Synchronous Motors: Yesterday and Today (*Continued from page* 99)



STREAMLINED MOTOR DESIGNS are contrasted with an earlier installation shown in the background. For these 500-hp 277-rpm vertical synchronous motors the switchboard is inclosed in the steel cabinet of latest design for safety

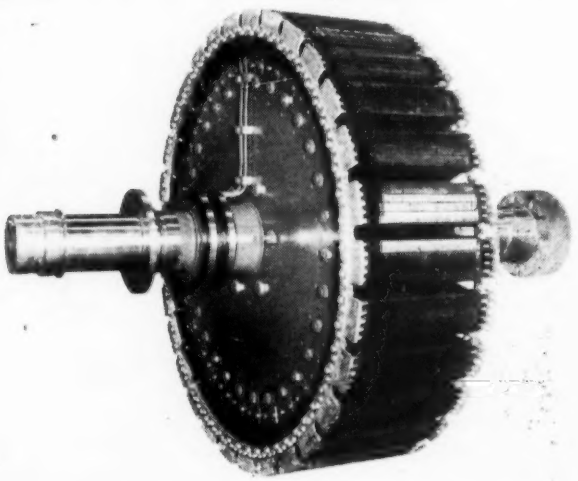


AMORTISSEUR WINDINGS for moderate starting duties were well advanced by 1927; shown in this 5000-hp rotor



BY 1908 amortisseur windings, bolted and riveted as shown here, were used in motors for light starting duty

THIS ROTOR, for 1500-hp 240-rpm 2200-v synchronous motor, shows the latest extra heavy amortisseur design (below)



TAFT-HARTLEY ACT

Frees "Slave" Labor

THE TAFT-HARTLEY ACT is two months old. Its full meaning is yet to be determined by decisions of the National Labor Relations Board and the courts. However, on its face, the Act refutes the attacks made upon it by union leaders as hysterical and fanciful.

Management has had every provocation to reply to these attacks in kind. To the credit of the employers of this country, they have not succumbed to that temptation. They have maintained a temperate attitude toward the new law and the problems it is designed to correct. This approach is right. But it is only an approach.

Union leaders will want to settle for nothing short of *repeal.* Their attack on the Act has made some headway. It may be more effective as time goes on. *Certainly the Taft-Hartley law will be repealed if management just sits tight and lets union leaders continue to confuse their followers.*

Management, therefore, must implement its present temperate attitude with a program of positive action. The Taft-Hartley Act must be made to work not because management wants it, but because it is fair to labor — and management can do things right now to see that the Act works. Management can:

I. Utilize every means at its disposal to acquaint the rank and file of union workers with the truth about the Taft-Hartley Act.

II. Suggest amendments to the Act if experience indicates that amendments are necessary.

III. Use the law as little as possible in settling labor disputes.

IV. Stand firm in its refusal to bargain away the rights accorded by the Act to workers, management, and the public.

An examination of those four *must's* will show why they provide management with its best program of action.

I.

Union members do not know what the Taft-Hartley Act provides.

There is abundant proof of that statement.

While Congress was still trying to write a law that the President would not veto, FACTORY magazine asked workers how they felt about major proposals in the pending House and Senate bills. Overwhelmingly they felt good. They were in favor of almost every individual provision that was finally incorporated into the bill and passed over the President's veto.

The same story emerged from the national opinion poll made by the Opinion Research Corporation of Princeton, N. J. and published by Look magazine after the law was enacted. It showed that union members uniformly favored major provisions of the Act, but were strongly opposed to the Act itself.

This inconsistency is easily explained. Instead of telling their members what the Act does for them, most union leaders have been condemning it as "a slave labor law" because it curtails the leaders' power and recognizes the rights of the union member and the public.

It is not a slave labor law. All of the basic rights accorded to labor by the Wagner Act of 1935 are preserved by the Taft-Hartley law. All of the unfair labor practices that were forbidden by the Wagner Act are still forbidden by the Taft-Hartley Act.

Nothing in the law impairs labor's right to bargain through representatives of its own choosing.

The Wagner Act condemned as an unfair labor practice any effort by employers to coerce employees in the selection of their bargaining representatives. So does the new law.

The Taft-Hartley Act merely recognizes rights of individual employees, of management, and of the public that were ignored by the Wagner Act.

For example, while the Taft-Hartley Act continues the workers' protection from coercion by employers, it also gives them new protection against coercion by unions. The individual worker is freed from the necessity of joining a union to *get* a job. He may still be required to join a union to *keep* his job, but not unless a majority of the workers vote for such a requirement in a government-supervised election.

Some people think the Taft-Hartley Act is weak in protecting the rights of the individual worker. They think that membership in a union should never be made a condition for holding a job. This is true. However, the Act does restore to the individual worker some rights which were blotted out under the Wagner Act, just as it does to management and the public.

A fair examination of the new law's provisions will show that they spring from one dominating purpose: i.e., to re-establish equality before the law.

For example, under the Wagner Act union leaders were free to say whatever they pleased about the employer to his employees. The employer, on the other hand, was denied freedom of speech in talking to his own employees. Now freedom of speech is largely restored.

Under the Wagner Act the employer was compelled to bargain with a certified union. Now the union must bargain, too.

Under the Wagner Act, unions alone had the right to petition for an election to determine whether the petitioning union represented a majority of the workers. Now the employer also has the right to secure an election.

These are features of the new Labor law that management must help workers understand. They must understand why the Act is not the "diabolical monstrosity" Philip Murray tells them it is.

Some companies have already started to explain these things to their workers. Techniques are well established, and they are techniques that any company can use. They include labor law digests in language workers can understand, supervisory conferences to cover points in the Act that affects the supervisor's handling of his job, distribution of reprinted articles that point out how employees benefit from the new law, editorials in plant newspapers and magazines, and advertisements in local newspapers.

II.

Management should take the lead whenever amendments to the Taft-Hartley law become necessary.

For twelve years labor leaders wilfully opposed every attempt to correct obvious abuses in the Wagner Act. We have now proved that a labor law *can* be amended. Let us be sure that management does not resort to the same obstructionist tactics labor has always used.

In carrying out its basic purpose to re-establish equality before the law, the Taft-Hartley Act makes it "unlawful . . . for any corporation whatever or any labor organization to make a contribution or expenditure in connection with" national elections. Corporations have long been so restrained. The novelty is the balancing restraint upon unions, which now have huge financial resources amounting to very many millions of dollars. However, the language of the Act *may* restrain the labor press from saying what it thinks about candidates, thus impinging upon the freedom of the press. Senator Taft has recognized this possibility.

If it should develop that the Act inadvertently throttles freedom of the press—or misfires otherwise—management should take the lead in securing suitable amendments to the Act. By assuming a completely stiff-necked attitude toward any and all changes in the Wagner Act, no matter how badly needed, the dominant labor leaders and their political outriders finally brought on the sweeping revisions provided by the Taft-Hartley Act. Management must not follow that example of stupid leadership.

III.

Management will be wise if it uses the new law gently in settling labor disputes.

So far employers show no disposition to use the law excessively. That is good. An analysis of the NLRB's docket from August 22 to September 30 shows that approximately 90 percent of the cases now before the Board were filed by unions and employees—not by employers.

We have been surveying employers, asking if they will have occasion to use their right to sue their unions. The answer so far is consistently, "*no.*" That answer frequently is accompanied by this remark, "We certainly hope not. We have no desire to conduct our labor relations in the courthouse."

The desired result should be for the Act to produce only those law suits that are matters of vital principle. As many employers have remarked, the courthouse remains the worst possible place to conduct labor relations. The best place is in the plant—by free collective bargaining between parties enjoying an equality before the law. The Taft-Hartley law will serve its most constructive role if it encourages this kind of collective bargaining.

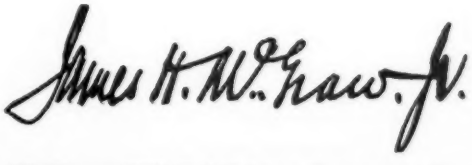
IV.

Employers should not bargain away legal rights accorded to them by the Taft-Hartley Act.

By bargaining away rights given them in that Act, employers serve only to upset a carefully created balance of equality before the law which is an essential element of fair collective bargaining.

Also, by bargaining away rights properly accorded to them, they let down those members of Congress who, in voting for the Act, braved continuous threats of political assassination by powerful union leaders. For their statesmanship in the complicated field covered by the Taft-Hartley Act these Congressmen deserve the support and gratitude of the whole nation—of management, of labor, and of the public alike.

Fairly handled on all sides, the corrective force of the Act can be made a major bulwark of industrial freedom.



President, McGraw-Hill Publishing Company, Inc.

New Instrument Developments Discussed at Conference

▶ MEETING AT THE STEVENS HOTEL in Chicago, Sept 8–12, The Instrument Society of America held joint sessions with the Industrial Instruments & Regulators Div of ASME. Members and visitors, totaling 7000, visited the exhibit to examine new instruments and controllers of 139 manufacturers, and hear fellow engineers speak on related subjects.

Educational Lectures. Considerable time was devoted to educational classes in the practical application of instruments and controllers on such subjects as, *Pressure and Thermal Systems*, by George E Heller, Taylor Instrument Cos; *ABC of Automatic Control* by C E Mason, Bristol Co; *Flow and Liquid Level*, by L K Spink, Foxboro Co; and *Electrical Temperature Measurements*, Martin Ladden, Brown Instrument Co.

Engineering Papers. In *Applications of Viscosity Measurements in Petroleum Refining Operations*, D J Pompeo, Shell Development Co, discussed the control of refining operation as applied to lubricating, fuel and diesel oils, jet fuels and various types of cutback asphalt. R H Kienle and E I Stearns, Calco Chemical Div, in the paper, *Adaptation of the Automatic Spectrophotometer for Special Measurements*, told how a recording spectrophotometer may be used for such measurements as chemical identity, quantitative chemical analysis, reaction rates and refractive index.

Instrument Installation and Maintenance Methods and Practices in a Modern Oil Refinery, by G A Larsen, Texas Co, discussed shop facilities, personnel and standardization of installations to simplify the training program. A B Sisson, Public Service Co of Northern Illinois in *Instrumentation in Turbine Testing*, explained the need for proper calibration of instruments to secure accurate and dependable readings. He also included preparations for the test and personnel required.

Outlining practices of checking new instruments, attaching proper identification and modifications to meet storage, handling and usage conditions were discussed in, *Instrument Servicing and Maintenance in an Educational and Research Electrical Laboratory*, by H N Hayward, University of Illinois.

Moisture Measurement With an Electronic Dew Point Indicator, by V Suomi, University of Chicago, described a hygrometer that maintains a small metal mirror at the dewpoint temperature by means of photoelectric observation and induction heating.

W H Fortney, Humble Oil Co, in *Application of Conventional Industrial Instruments to Power Plant Control*, described two installations of high-pressure boilers and their water-conditioning plants fitted with control instruments.

Highlight of the meeting was a practical demonstration of how to fit a controller to its process, presented by G F Akins, Eastman Kodak Co. Akins began with a simple controller, showing how it reacted under different loads and lags and with different refinements designed to iron out cycling, offset and other interfering actions.

Industrial Instruments & Regulators Div of ASME program consisted of: *Application of Mechanical Cascade Control Systems*, by J M Swarr, Corn Products Refining Co; *Floating Scale Manometers*, by W D Wood, Taylor Instrument Cos; *Design of Instrument Gears*, by G W. Kuntney, Brown Instrument Co; *A New System of Humidity Measurement*, by W F Hickes, Foxboro Co; and *Various Mechanical and Electrical Digital Calculators and Their Uses*, by Wallace J Eckert, Watson Scientific Computing Laboratories.

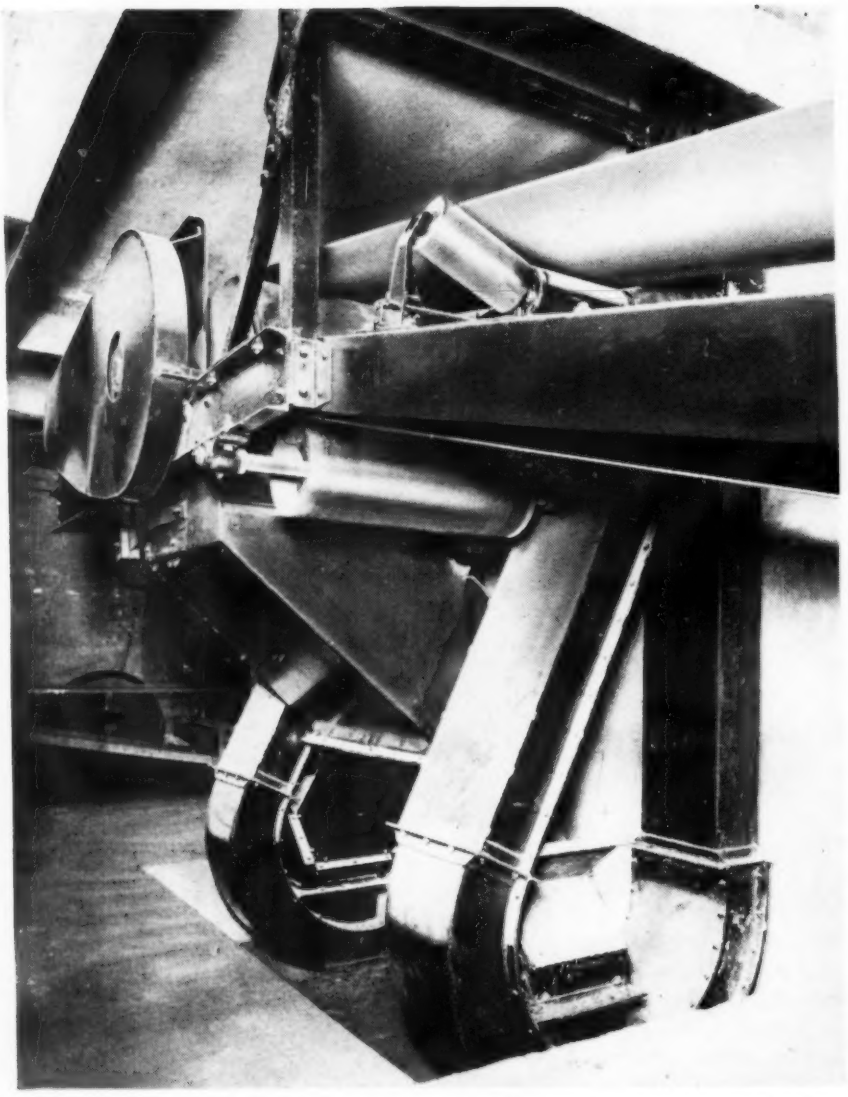
PAUL G EXLINE, new president of The ISA, is section engineer of Gulf Research Corp, Pittsburgh, Pa., and secretary of the Industrial Instruments and Regulators Division of the ASME

Election. New officers for the coming year are: president, Paul G Exline, Gulf Research Corp; vice-presidents, H C Frost, Corn Products Refining Co and F H Trapnell, E I du Pont de Nemours. Holdover vice-presidents are Professor C F Kayan, Columbia University, and H H Barnum, H H Barnum Co. Also held over for the second year of their 2-year term are: treasurer, H E Ferguson, Peoples Gas Light & Coke Co, and secretary, Richard Rimbach, Instruments Publishing Co.

Next conference will be held in Convention Hall, Philadelphia, Pa., Sept 13–17, 1948.

Have You a Powder Keg Under Your

Make sure your operations are safe by checking these pointers on causes and prevention of gas and dust explosions. William G Hudson, materials-handling engineer, considers coal, wood, metallic and plastic dust explosion hazards



CLOSED SYSTEM with belt conveyor discharging to either of two loop-type continuous-flow elevators in which coal moves as a core and prevents updraft

► ENGINEERS SPECIALIZING in materials handling are familiar with the risks in handling and storage layouts where an explosive gas may be present. The general impression, that only coal, grain, wood and similar dusts form explosive mixtures with air, is erroneous. Other dusts are as hazardous; some actually give explosion pressures far greater than those mentioned. Moreover, as many of these dusts are derived from materials involved in new industrial processes, it is important to understand the hazards and their correction.

Many metal powders, such as zirconium, magnesium, aluminum and titanium, are more hazardous than carbonaceous dusts. This is important to those interested in powder-metallurgy processes. Another rapidly expanding field involving explosion hazards is the plastic industry. Some of the plastic powders have a more intense explosibility than do coal or grain dusts.

Bureau's Findings. U. S. Bureau of Mines has had this subject under investigation for some years. Its efforts, which were first directed toward elimination of dust explosions in bituminous-coal mines, have been extended to cover industrial-dust explosions. Its findings* are of such interest to materials-handling engineers that they warrant careful study, especially by those who select equipment and route products through a plant.

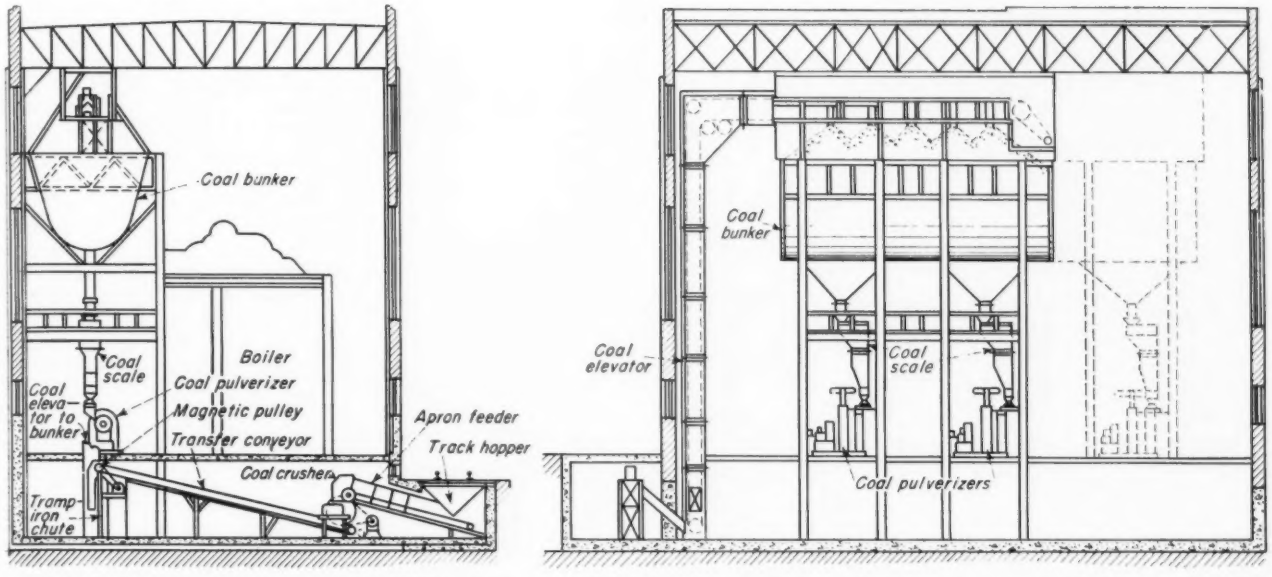
Requisites for a dust explosion are (1) a cloud of dust in suspension in air within certain limits of saturation and (2) an ignition source to start combustion. Conditions necessary for an explosion frequently exist where operations include grinding, screening, crushing, mixing and drying of any material that burns or oxidizes readily and that exists in powder form.

Causes of Explosions. Explosions often occur in or around grinding machinery that produces dust or fine particles. Nails, bolts or pebbles may accidentally enter a machine and strike sparks, or jam to produce excessive heat. Dust clouds produced in bolting, sifting or screening operations are subject to possible ignition from static sparks. Passage of materials through conveyors and elevators may give rise to dust-explosion hazards. Mixing and blending operations are usually accompanied by generation of dust, and static electrical discharges are believed to be responsible for some of the dust explosions that have occurred in the processes.

In driers and kilns dust clouds often form during normal operation, particularly with spray driers in which explosive concentrations of fine, dried material may be present throughout the operation. Heat of the drier may be sufficient to ignite the dust cloud. Operation of dust-collecting systems, with fine

* These findings are included in the Bureau's *Information Circular* 7309 (Jan 1945) by Hylton B Brown, senior engineer, Bureau of Mines, Eastern Experiment Station, College Park, Md.

Plant That Is About to Explode?



TYPICAL COAL-HANDLING LAYOUT with apron feeder, crusher, transfer conveyor and magnetic-head pulley, gravity discharge and elevator to bunker. Dust generated at crusher should be vented from basement tunnel. Magnetic-head pulley protects crusher and eliminates danger from sparks. When coal is dry a dust cloud rises from bunker. Wall it off from the boiler room, or have a cover, extending up to the conveyor-gate opening, and well vented by fan

material passing through metallic ducts at high velocity and whirling around in the collector, may produce high-voltage charges of static electricity. In a New Jersey plant the system, which handled dust from the wood shop to a boiler-room receiver with chute to a stoker, blew up causing severe damage and injuring several men. Whether this accident was caused by static electrical discharge or by a flashback from the stoker could not be determined.

In the course of their research work Bureau engineers developed equipment for laboratory experiments with which it is possible to determine the ignition temperature, relative inflammability, ease of ignition, limits of explosive concentrations, and pressures developed following ignition of dust clouds of different concentrations. With this equipment much valuable data have been obtained on dust explosions.

In these tests, 200-mesh material and other sizes were used to obtain a direct comparison of results with different dusts. It has been demonstrated that 8-mesh material is too coarse to enter into inflammability or explosive reaction. The 20-mesh fraction of coal dust does not ignite and propagate flame readily, but appears to be capable of contributing to an explosion if it is initiated in finer dust. Flame propagation and high pressures are obtained with 20- to 200-mesh dust.

For 200-mesh coal dust, minimum explosive concentration is 0.055 oz per cu ft of air. This means that in a chamber 10x10x10 ft more than 3 lb of coal dust must be in suspension before the dust-air mixture is explosive. Offhand this condition might lead to the conclusion that the danger is slight, but many explosions of coal and other dusts have occurred that prove explosive concentrations are often present, or can be readily produced in and around grinding and crushing equipment.

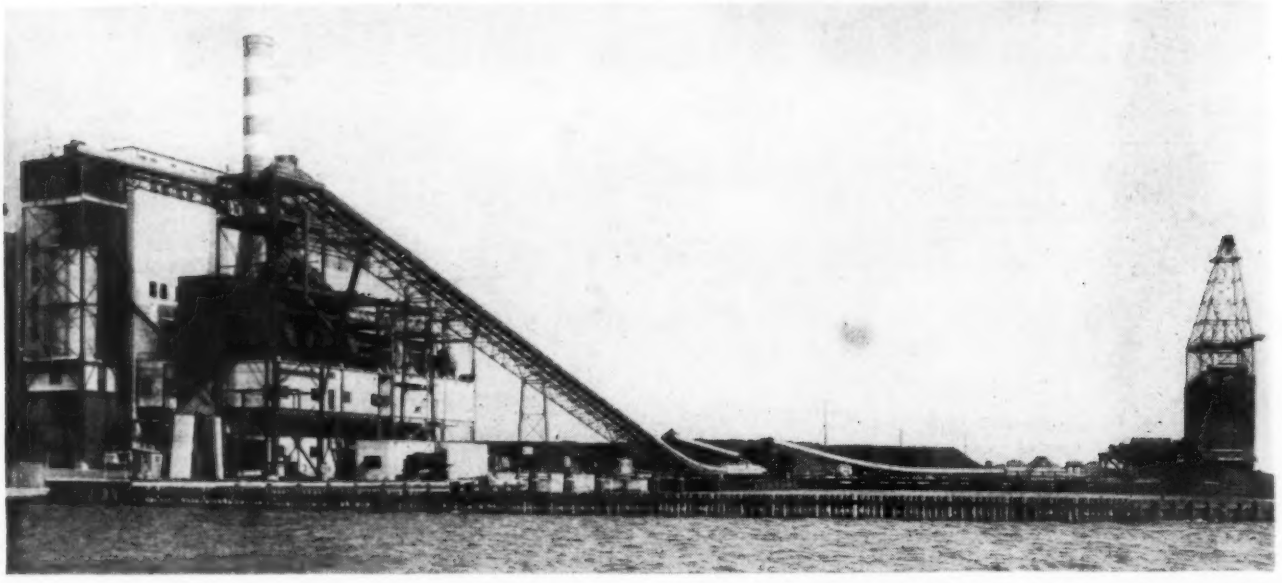
It is not necessary for an entire room to be filled with explosive dust-air mixture before there is a disastrous explosion. A local accumulation of dust on ledges, bracings or supports may be thrown into suspension by a jar or shock. If this small volume of dust is ignited the resulting pressure wave stirs up other dust, which is added to that already in suspension in the air. Thus an expanding dust cloud, dense enough for flame propagation, may be formed in the room and galleries.

The Bureau has tested and classified more than 130 carbonaceous dusts. Maximum rate of pressure rise, which is the indicator of the severity of explosion hazard, ranges from low to high for dusts in this group. Grain dust has a rate of pressure rise, 200 lb per sq in. per sec; coal dust, 780 lb per sq in. per sec; cornstarch, 1590 lb per sq in. per sec.

Metal Powder. Magnesium powder is a good example of metal powder that forms explosive dust clouds in air. It ignites at a dust-cloud temperature of 520 C, has a minimum explosive concentration of 0.02 oz per cu ft, and a maximum rate of pressure rise of 4760 lb per sq in. per sec.

Alloys and metals tested included aluminum, antimony, iron, lead, magnesium, tin, titanium, zirconium, and alloys or mixtures of these and other metals among the 30 or more now available in powdered form. As with the first group, the pressure rise ranges from low to high. Lead powder presents virtually no dust-explosion hazard. Even though its dust clouds can be ignited at 580 C and the relative inflammability is 20, maximum pressure produced is only 2 lb per sq in. Aluminum dust produced the highest rate of pressure rise measured, 5700 lb per sq in. per sec.

Zirconium is particularly hazardous. It has a maximum rate of pressure rise of 2575 lb per sq in. per sec, and a dangerous ignition factor. Ignition was



COAL-HANDLING SYSTEM at large utility steam plant has long inclined belt-conveyor bridge with only conveyor housed. This setup reduces fire and explosion hazards, and costs much less than does the usual bridge housing

obtained at room temperature without outside heat or flame when the finely divided powder was blown into the air, probably caused by static electricity on the dust particles.

Plastic Powders. Some of the phenolic resins illustrate the hazard of dust explosions in plants manufacturing or using plastics in powdered form. Tests with a sample of phenolic resin had a dust-cloud ignition temperature of 500 C, a minimum explosive concentration of 0.025 oz per cu ft, a maximum pressure at 0.05 oz per cu ft of 61 lb per sq in., and a maximum rate of pressure rise of 3160 lb per sq in. per sec. This group includes phenol, urea, vinyl and other resins, and a number of molding compounds and primary ingredients.

Materials Handling. Typical dangerous conditions exist when coal is dropped into an open bunker from electric distributing cars, from a belt-conveyor tripper or through the long chute of a skip hoist. Unless multiple-chain chocks provide careful protection against reversal, long steeply inclined flight conveyors, installed to carry material from a mine slope to a preparation plant, may start backward, generating a cloud of dust inside the mine where sparking trolleys are present. The reverse of this is the retarding conveyor, which, if it gets out of control, produces an explosive dust cloud in the inclosed structure at the foot of the slope. Unless a high bucket-elevator casing is vented, it forms a flue or chimney, especially if it handles hot material that carries fine dust upward and out at the discharge chute.

A long, inclined belt-conveyor housing constitutes a flue, distributing the dust cloud throughout its length. It is a simple matter to partition the run into sections suitably vented. Interior of a crusher or breaker house is often dusty, and the beams and supports accumulate dust deposits. A piece of tramp iron may strike a spark and cause an ignition. Where an inclined conveyor discharges to a tandem conveyor much dust is scattered. This is readily removed by a hood and exhaust fan, vented to the roof. A fan with a capacity of 1000 to 1500 cu ft per min and 4-oz suction takes care of the dust from belt conveyors up to 36-in. width.

Dust-Explosion Prevention. Safety against dust explosions lies in eliminating free dust and sources of ignition by suitable provision for ventilation and dust collection. This includes approved conduit wiring, dustproof switches and control equipment, totally inclosed or explosion proof motors where dust-laden air cannot be avoided, and grounded metallic parts where static electricity is suspected. Other sources of danger are open flames or lights, smoking, and steel-plate walkways.

Gas- or coal-burning rotary driers, for dusty products liable to ignition or explosions, should be operated where the atmosphere is as nearly inert as possible. If the air is recirculated through the drier it should be cleansed before it is reheated.

Instead of water, emergency fire-extinguishing equipment may include graphite, talc, sand or other inert dry material for smothering fires in magnesium, aluminum and other metal powders. Carbon-tetrachloride and carbon-dioxide pressure extinguishers sometimes tend to spread fire in these dusts.

Use constructions that would vent or release explosive pressures should ignition occur. Inclosures are vented by lightweight panels in side walls, roofs, elevator casings, conveyor housing and closed storage bins. Make panel areas as large as possible for the inclosed volume. Such emergency pressure-release protection is more effective for dusts with a medium rate of pressure rise than for those with a high rate.

Several sections or divisions of the plant should have heavy firewalls with automatic doors to restrict hazardous areas. Provide stair wells, elevator shafts and floor openings with emergency inclosures. Where hazards are extreme, isolate processes in detached unit structures. Fire underwriters' rules cover all these recommendations and others.

The Dust Explosion Hazards Committee of the National Fire Protection Association, composed of representatives of the U. S. Bureau of Mines, U. S. Dept of Agriculture, industrial organizations, and other groups interested in explosion prevention, have prepared safety codes covering hazards in a number of industries. Seventeen of these safety codes, which have been approved as American Standards, may be obtained from National Fire Protection Assn., 60 Batterymarch St, Boston 10, Mass., or National Board of Fire Underwriters, 85 John St, New York, N. Y.

THE OPERATING ENGINEER

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Faulty Ignition Endangers Boilers

Here are the risk periods when ignition failure explodes a setting. F X Gilg, application engineer, Babcock & Wilcox Co, gives positive operating measures using manual methods and available mechanical aids for reducing hazards

▶ MOST FREQUENT CAUSE of furnace explosions is faulty ignition in installations that are fired by oil, gas or pulverized coal. Hazards from this cause can be reduced to the vanishing point by positive steps toward ignition control during these periods: (1) lighting off (2) initial operation (3) uncertain fuel supply.

All these critical periods have one thing in common, a potential explosive force in gas and unburned fuel that can accumulate in the setting and stand ready to ignite should a flame or spark reach them.

What are the positive steps that an operator can take to meet this hazard? The principal measures recommended are (1) mechanical aids and (2) operating procedures.

Mechanical Aids. These usually appear on large-capacity high-pressure installations, such as those in central stations or large industrials. Let's see how some of them work. The functions they perform can be duplicated on smaller-capacity units by manual-operating procedures.

Automatic purging employs a "purge meter." This mechanical device interlocks electrically with the fuel supply to prevent turning on the fuel until the purge meter is satisfied by a predetermined draft differential across the boiler for a set period of time. This indicates enough flow of fresh air through the setting to get rid of all accumulated gases. Only then can fuel be turned on to light torches and main fuel supply.

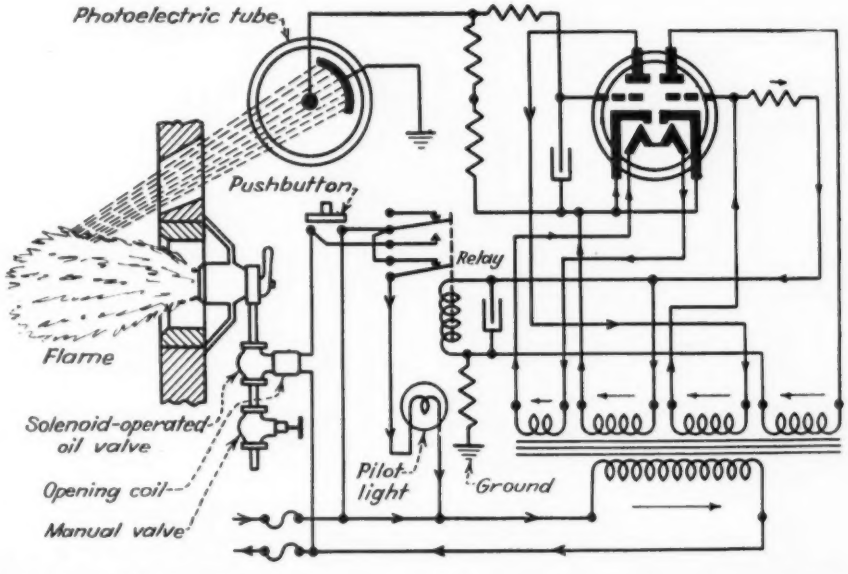
Such purging can also be performed manually. It merely requires holding open the dampers until enough air has flowed through the setting to replace all gas. An alert operator insists upon proper purging because to neglect it is to court disaster. Once the purge has been completed lighting torches can be inserted.

To guard against premature starting up of the fuel supply it is a simple matter to interlock electrically forced- and induced-draft fans with fuel supply to insure a sequence in starting up and shutting down that purges the setting.

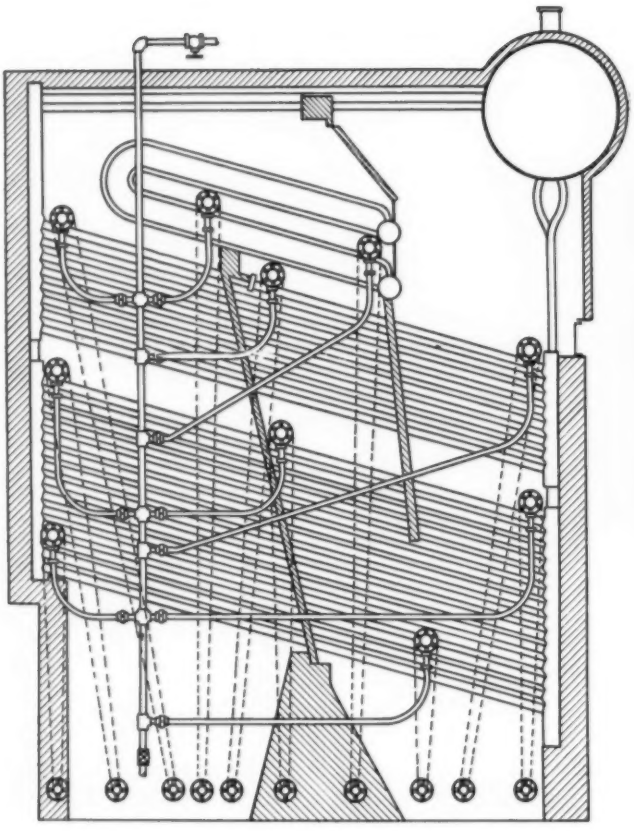
So much for starting up and shutting down. How about an interrupted fuel supply? Again there are mechanical aids such as flame-failure devices that warn if ignition has been lost.

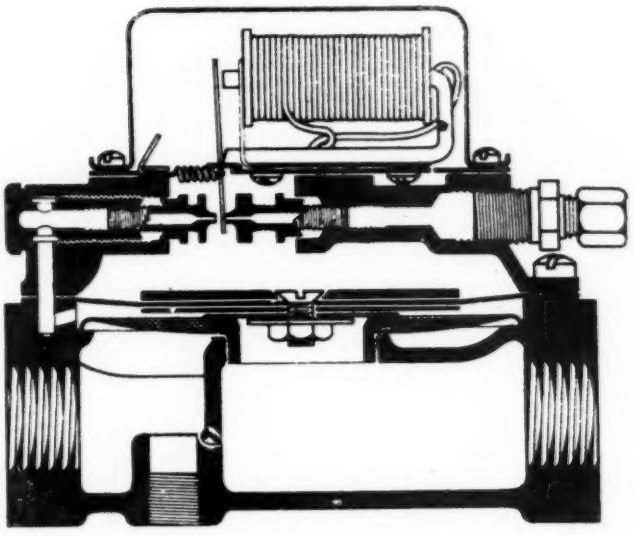
Operating Procedure. There is nothing that contributes to safety quite so much as an operator who is thoroughly familiar with the requirements of each part of his equipment.

For instance, if ignition has been lost during operation when the setting is hot, the fuel supply should be shut off completely. If the unit is on automatic control, reset to manual. If the



FLAME-FAILURE PROTECTION for an oil-fired system uses a photoelectric tube for flame watching. A pushbutton opens the solenoid-operated fuel valve





ELECTRIC-RELAY CONTROL of gas feed draws its operating current from a thermocouple in the pilot-burner flame

SOOT-BLOWER SERVICE, only at boiler ratings high enough for stable ignition, avoids possible explosion hazard

load at flame failure was at least 25% of maximum, reduce air flow gradually to the amount required for that load and purge at least 5 min.

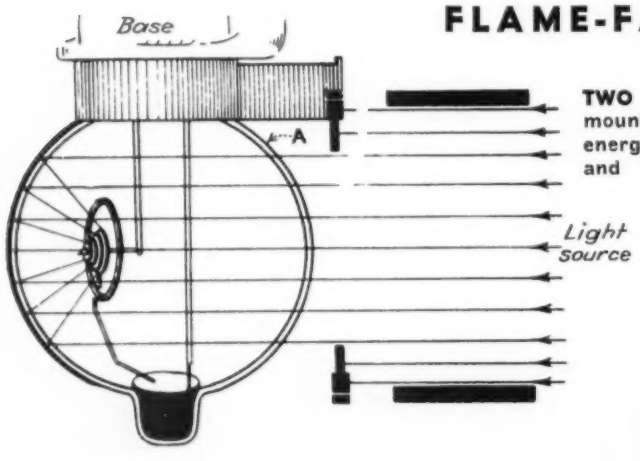
If the load happens to be less than 25% of maximum at flame failure *don't* change air flow under any circumstances because some smoldering soot particles might be disturbed, and set off an explosion before purging is complete. Time for purging runs no less than 5 min and as much as 30 min, if the load at the time of ignition failure was as low as 5% of maximum.

Pilot lights have been advanced as a possible solution for furnishing ignition when fuel supply is restored. This method, while successful for domestic heaters, falls short of the answer in power boilers because it might ignite an explosive accumulation of combustible gas within the first few moments after fuel supply is restored. Purging alone assures that all combustible gas goes harmlessly out the stack before ignition is reestablished.

There is still another hazard that could develop with a pilot-light installation, that is, the use of a standard piece of boiler equipment—the soot blower. Steam issuing from this unit could conceivably blow out the pilot light and the fire while dislodging smoldering soot. The combination might set off an explosion. In fact, a universal operating instruction calls for soot-blower service only at boiler ratings which are high enough to insure stable ignition and at which there is no possibility that the fire will be blown out.

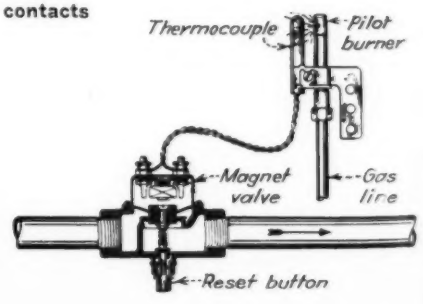
Initial Start-Up. Now let's consider

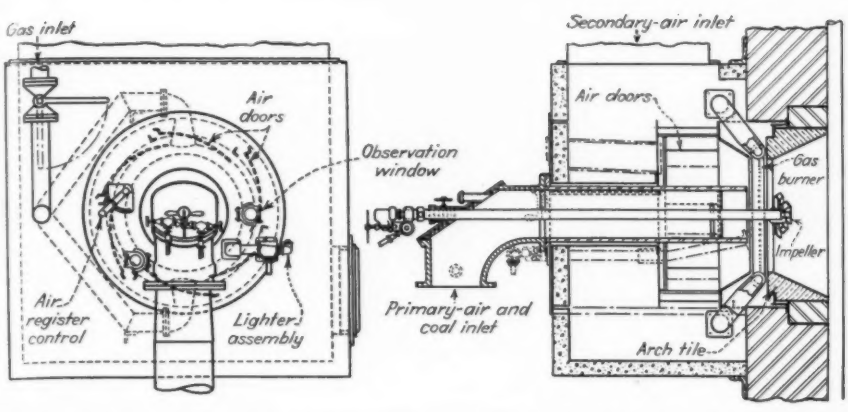
FLAME-FAILURE DEVICES



TWO bimetallic spirals (left) mounted in glass receive radiant energy from flame to expand spirals and close fuel-control contacts

FLAME generates voltage in magnetic circuit to hold valve open. When the flame fails valve shuts





AUTOMATIC LIGHTER for pulverized coal, oil or gas interlocks electrically with draft fans to make certain setting was well purged before lighting off

initial start-up, either from scratch or after some maintenance work has been done in the setting.

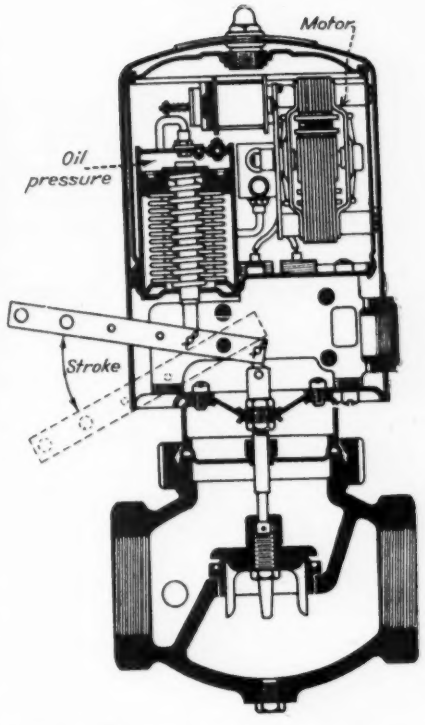
The seemingly acceptable practice of leaving scaffolds in the settings to be burned away on starting up may provide glowing embers to regions of accumulated explosive-gas mixtures. Safe operation should insist on removal of all scaffolding or similar bodies that by smoldering for long periods could act as the spark-source for explosions.

Automatic lighters, above, furnish a mechanical means for pushbutton starting from a panelboard for pulverized coal, oil or gas. The lighters interlock electrically with the fans to make certain that the setting has been purged properly before lighting off. Several flame-detection devices, facing page, are on the market. Some sound alarms, while others shut down the equipment upon flame failure.

An alert operator checks this function even when he has mechanical aids. A properly placed burner peep door or mirror provides the means of visually checking ignition torches; for instance, before turning on the main fuel supply for the burners. The practice of lighting one burner from another, or from hot brickwork, is highly dangerous and should never be used under any circumstances. The possibilities of delayed ignition and subsequent explosion are the chief dangers.

In almost any operating situation a competent operator is the best safeguard. Many flame-detection devices sound an alarm rather than automatically shutting down the equipment. The reason behind this preference is a desire to use the experience and judgment of an operating man fully informed of prevailing conditions that make the shutdown necessary.

Personal hazards in furnace or gas explosions can be guarded against by securely latching all doors. Explosion-relief doors, when used within 7 ft of platforms or walkways, should be equipped with protecting hoods. Any sudden increase in pressure within the furnace or setting may result in a discharge of hot gas and cinders, which is diverted by the hoods.



HYDRAULIC motor valve controls feed. Actuating oil pressure ties in the magnetically controlled flame device

Incompetence Causes Accidents

► DESPITE GREAT PROGRESS in safe design and construction of pressure vessels and the use of proper safety devices and automatic controls, operators' errors remain a hazard, as shown by these claims an insurance company paid.

A 7-section oil-fired cast-iron boiler for hot-water supply in a children's home let go in a $6000 explosion. It all started from a simple maintenance job on a hot-water tank served by the heating boiler.

The boiler had been shut down and valves between boiler and hot-water tank closed while repairs were under way. Once completed, the repair crew opened the valves and reported to the operator that all was clear to fire up the boiler again. The operator, not realizing the valves were open, turned each of them —but in the wrong direction. He *closed* them!

Without normal circulation, water temperature and pressure within the boiler built up rapidly to a point where the boiler blew up. A relief valve mounted on the unit failed to function properly and prevent the accident.

Another loss of a similar cast-iron heating boiler occurred from neglect. The water level was allowed to drop, and to make the accident more incredible the gas-fired unit was equipped with an automatic water feeder and a low-water cutoff.

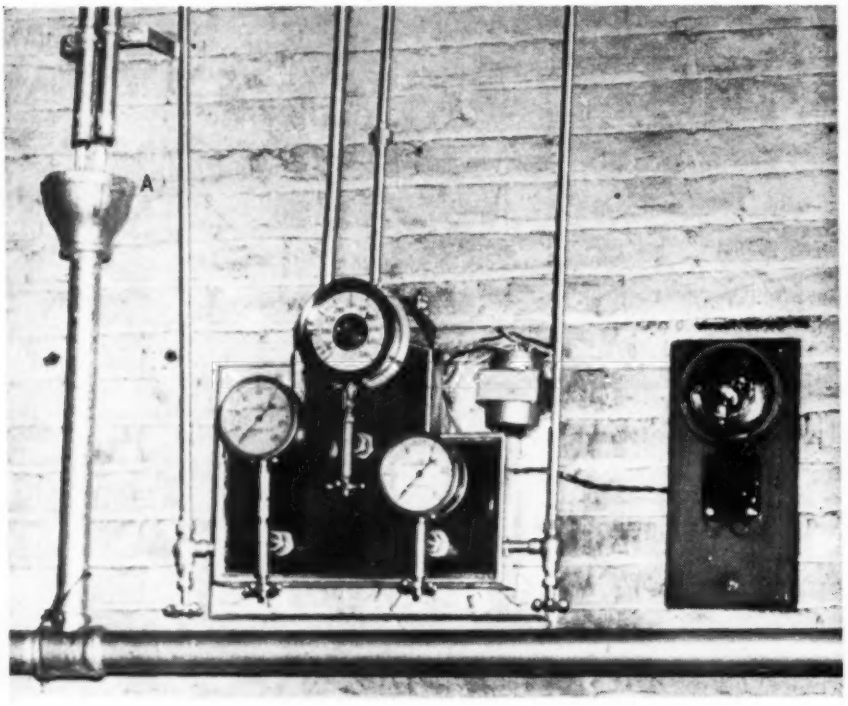
The low-water feeder had not been working but its repair had been postponed. On top of that the low-water fuel cutoff was also out of order. To cap these errors the operator neglected to watch boiler water level. Design of automatic controls was all right, equipment able to do its job. Controls were just choked with scale, sediment.

Still another case of operator-failure from low-water level, this time from a woeful lack of operating know-how, occurred with a 54-in. stoker-fired Scotch marine boiler.

When the feed pump stopped, the operator became excited and could not start it again. He overlooked an injector available as a standby for just such a condition and placed the boiler under manual control. He lit out then in search of the plant superintendent, and the boiler overheated and collapsed before he got back.—*The Locomotive*

PRACTICAL AIDS TO OPERATION

Plant-Tested Methods and Ideas for Power Men



OPEN WATER LINES EXPOSE FLOW

When our six air and refrigeration compressors were first installed the return cooling-water line from each compressor connected directly to a return header. This arrangement did not permit observing water flow in these lines. As a result compressors were sometimes started without turning on the cooling water, or were operated with too much or too little water flowing in the cooling systems. As the operators could not see the water flow in the cooling lines, and alarms were not installed to call attention to abnormal conditions, they could hardly be held responsible for occasional mistakes.

To correct this condition we opened all the cooling lines about 6 ft from the floor and provided for free flow from the discharge end of the pipes into a 6- to 1½-in. pipe reducer on the connection to the return header, as at *A* in the photo. An operator can now see the water flow in the lines and check its temperature with his hand. Since making this change we have had no trouble because of operators making mistakes in handling the compressor cooling-water systems. On my trips through the plant I can observe the water flow in the cooling-water systems. Before the change was made I had to rely on the operator's word, or try the inlet valves.

Brooklyn, N. Y. J P Carey

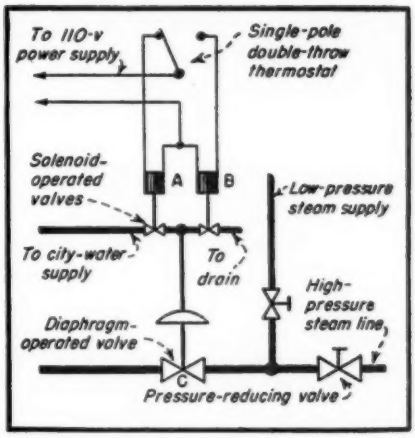
Solenoid Valves Control This Heating System

We had a temperature-control problem with our office-heating system, which we solved by a homemade temperature regulator, shown in the diagram. Normally, heating steam comes from the low-pressure system, any deficiency being supplied from the high-pressure line through a reducing valve.

To regulate temperature in the office we installed a diaphragm valve in its heating-system steam line and controlled it by city-water pressure through two small solenoid valves actuated from the office thermostat. This unit is a single-pole double-throw design, which makes contact in either position.

When no heat is required the thermostat closes its left-hand contact to energize the solenoid valve *A*. This valve opens and applies water pressure to diaphragm of valve *C*, to close it and shut off steam from the office-heating system.

When heat is required, the thermostat trips to the right-hand position. This opens the circuit to the solenoid valve *A* and closes it to solenoid *B*. Valve *A* closes to cut out water pressure from the diaphragm of valve *C*. Valve *B* opens to drain, and a spring opens valve *C* to admit steam to the heating system. This cycle is repeated as required by the thermostat to maintain desired office temperature. The system has required practically no maintenance for over ten years.



Paterson, N. J. William Note

Bearing Oil Causes Commutator to Fail

A little oil, applied occasionally to a commutator that needs it, contributes to the much-desired polished surface. It is preferable, however, to obtain such

lubrication by using self-lubricating brushes. Too much oil on a commutator is a greater hazard than none because the excess tends to disintegrate the mica insulation.

Oil on the inside of a commutator impairs the insulation and eventually causes a ground from the bars to the metal shell. This is especially likely to happen on machines operating on grounded power systems. Oil in commutator-bar mica destroys its binder and in time the commutator develops black spots irregularly spaced around its surface.

The commutator of a large dc generator developed black roughened areas. We tested the armature equalizers and checked their connections. Even though everything was apparently all right we resoldered the commutator connections to eliminate any poor one that might exist. Commutator bolts were tightened and brush spacing checked. We also tried different kinds of brushes without finding the cause of the much looked-for trouble.

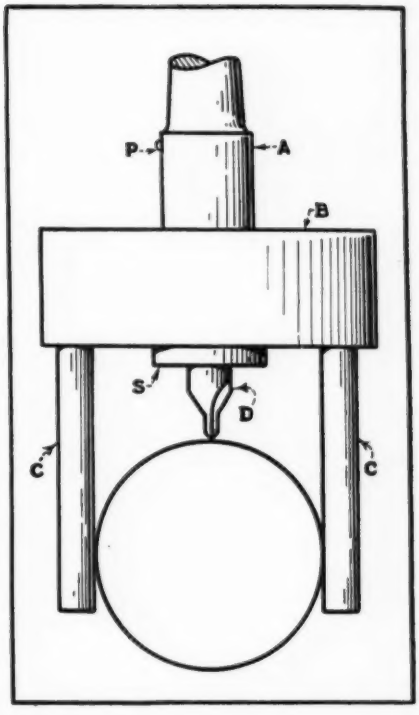
Then mica between commutator bars began to fail, leaving holes between them. We removed the commutator and, when it was opened for reinsulating, found its interior oil soaked from oil vapor thrown out from an adjacent engine bearing. Reinsulating the commutator and installing a suitable barrier to keep out oil vapors corrected the trouble.

Richmond, Va. C R ANDERSON

Drill Holder Locates The Shaft Centers

WHEN A SHAFT is held in V blocks or a vise, its center may be located with the tool shown in the drawing. This tool consists of a rotating part *A*, tapered at one end to fit a drill press chuck, and with a shoulder *S* at the other end. Block *B* has running fit on *A*. Lower end of *A* has a hole for center drill *D*, held in place by a headless setscrew. A pin *P* prevents *A* from dropping out of *B*. Block *B* is drilled for two tight-fitting pins, *C*.

To determine the center of a shaft held in V blocks, the tool is set in place and turned until its pins contact the shaft, as in the figure. If the shaft has a center hole rotate it until the drill enters the hole before tightening down the block and shaft. Vise jaws hold pins *C* against the shaft in vise-held work. Tool fits any size shaft that will go between its pins.



After center drill has entered to a depth for a guide hole, the tool is removed and the hole completed with correct-size drill and reamer.

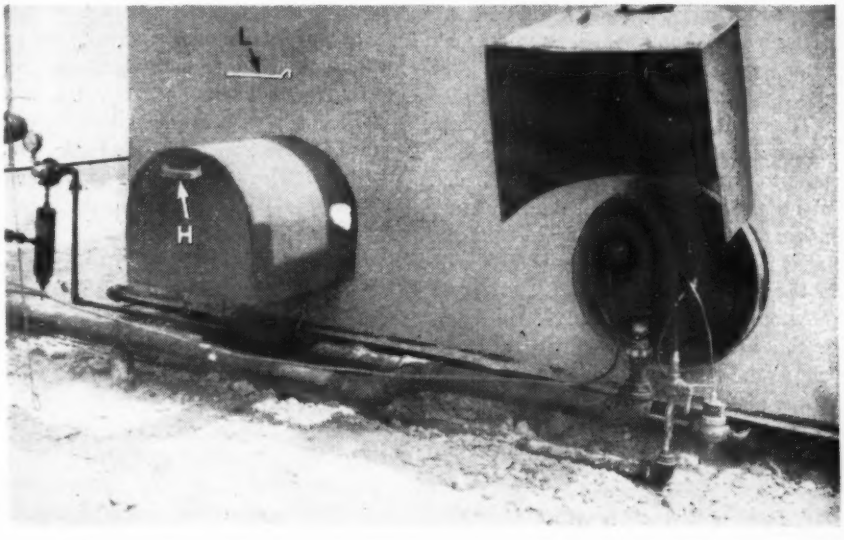
Leeds, England H MOORE

SHEET-METAL HOOD PROTECTS GAS BURNERS

GAS-FIRED BOILERS, which are operated out doors where high winds are prevalent, may interfere with correct operation of the burners. One plant installed Quonset-shaped hoods, made of thin sheet steel, over the burners, as in the photo. The burner end of the hood is left open, as shown on the right, and the top attached by a hinge welded to the hood and to the front of the boiler.

The hinge permits swinging the hood up clear of the burner, also shown on right, or to any position most favorable for firing. A small handle *H*, tack-welded to the hood's closed end, makes for easy handling. It also serves as part of a latch *L*. which holds the hood open when inspecting or repairing the burner or lighting the pilot.

Cleveland, Ohio A C WIGGINS



Cleaning the Heater Restores Feed Temperature

EVEN THOUGH some plants keep boiler-heating and condenser-cooling surfaces clean, little attention is given to the fouled condition of closed feedwater heaters. After going to work in one plant I happened to compare the current log sheets with those of two years previous. The old sheets recorded feedwater temperatures of 210 F and higher, while present temperatures were down around 180, with 10-psi back-pressure. This indicated something was wrong in the closed heater.

On examination. the heater's tubes near the steam inlet were found heavily coated with grease carried by the exhaust steam, and at the heater bottom there were lumps of heavy black grease and sediment. To clean the heater we filled it with water to within a few inches of the top and added 25 lb of cleaning compound.

We then admitted steam to the heater through a bottom connection by a hose connected to a 25-psi steam line. Overflow scum and dirty water escaped

freely from the heater's top. During the first 6 hr of cleaning, we added cleaning compound at the rate of 5 lb per hr. Condensate of the steam used to keep the water boiling maintained a steady overflow to clean the heater.

After 18 hr of boiling the steam hose was disconnected and the heater flushed out with a hose connected to the plant's high-pressure water system. When the heater was put back in service, feedwater temperature ranged from 220 to 235 with 10-lb exhaust for heating.

Lynchburg, Va. O M ROBERTS

Handles Cylinder Head With Simple Tackle

ONE OF OUR AIR COMPRESSORS needed frequent inspection, which required removal of the cylinder head. The three men needed to do the job were not al-

ways available. So, by the use of a simple hoist, I made it possible for one man to remove and replace the cylinder head more easily than the three men had done. This was particularly true because the work had to be done in a confined place.

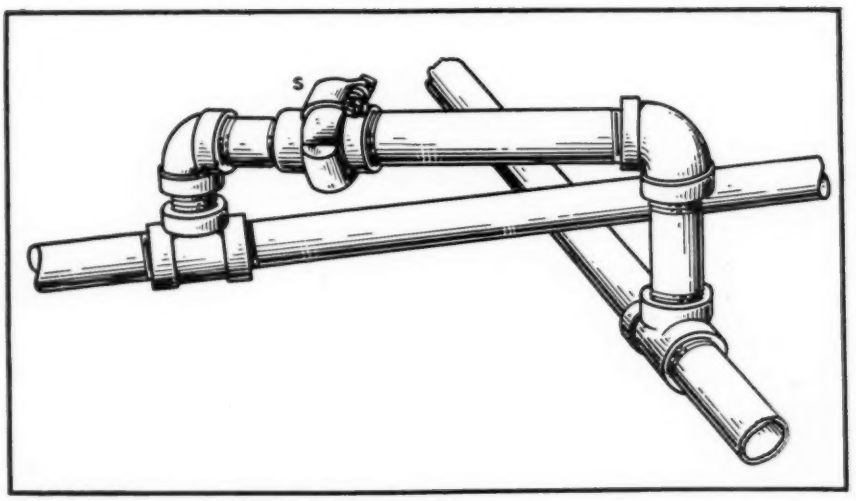
A boom for the hoist consists of three pieces of T-shaped steel, welded into a triangle at *T* in the photo. This boom connects to the air intake pipe by two divided rings bolted to clamp them to the pipe. One block of a hoisting tackle hooks into a ring in the boom's out end.

To connect to the cylinder head I made a Y, at *A*, with an eye in one end to hook into the lower block of the tackle. The free Y ends are threaded and bent at right angles, as shown. These ends are spaced so that they enter two stud holes in the cylinder head.

To remove the cylinder head, the mechanic takes out the two studs where he is to connect the Y. He then backs off on the other studs about one inch, moves the head out these distances, and with nuts secures the end of the Y in the empty stud holder.

After taking the weight of the head on the tackle, he removes the studs and swings the head out of his way to work on the piston and add new rings, if necessary. When ready to put the head in place he swings it back and with very little effort replaces the studs.

Brooklyn, N. Y. JAMES P CAREY



SPHERICAL JOINT EASES SWING CONNECTION

WHERE EXPANSION and contraction of a long steam line must be absorbed at one spot, the usual swing joint compounded of elbows and short lengths of pipe is inadequate. This is because of the turning moment imposed on the fittings' threads over the cycle of temperature change. On a 500-ft line used to bring in emergency steam while a power plant was down for overhaul, the engineer used the swing arrangement in the drawing. A spherical joint *S*, set close to one L, absorbed most of the travel with a minimum of torque transmitted to the threaded connections.

The spherical joint was installed to take a portion of the pipe elongation before the short connection between the Ls became straight. In this way the short nipple, forming the male end of the left-hand joint, had little or no tendency to move from its made-up position. Thus, the threads on the nipple from the steam main T and L took most of the wear in one piece of pipe, which would ultimately require renewal when it leaked at the thread.

Houston, Texas ELTON STEBBETT

Difficulties Did Not Stop This Engine

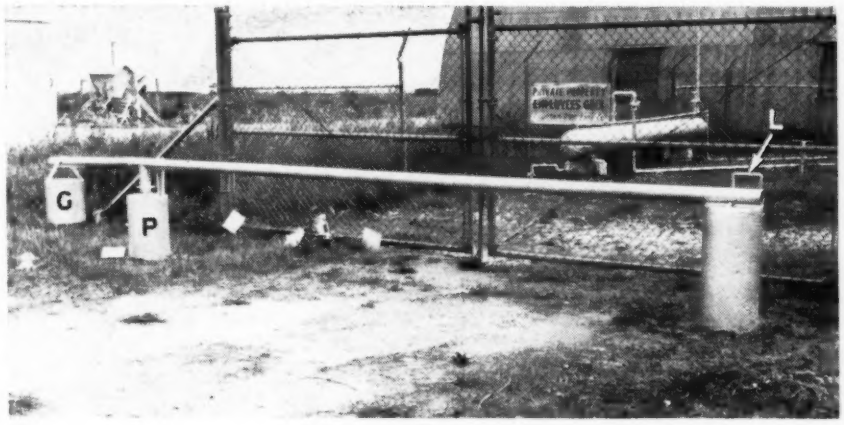
I WORKED IN A PLANT that had a 200-kw two-cylinder oil-engine-driven generator supplying power to an ore-crushing plant. Delay in receiving a tank car of crude oil necessitated the use for six days of a distillate with a specific gravity of 43 Baume. Contrary to expectations a higher spray pressure was necessary, to keep the exhaust free of smoke, than with crude oil. Fuel consumption was about 20% more with the distillate. The spray valves had a tendency to foul with carbon more quickly and the cylinder temperature was higher.

Shortly after we got the engine operating on its regular fuel again, a heat crack developed in one cylinder liner. Cooling water was not softened even though it was high in scale-forming matter that made efficient cooling difficult. We ordered a new liner by express, but kept the engine in operation. The crack enlarged, however, to let

more water into the cylinder until we decided to shut down and cut out this cylinder.

We did this by blocking all water, high-pressure air and oil connections, and removing the intake valve from the faulty cylinder. We then started the engine on the good cylinder and ran for six days under reduced load until the new cylinder liner arrived. None of the engine's bearings showed any signs of over-heating, but speed regulation was not as good and the fuel rate was slightly higher than on both cylinders.

Chicago, Ill. R C HENDERSON



NO CRASHING OF THIS PLANT'S GATES

TO PREVENT cars on the highway from crashing our plant gates, if they should use our short entry stub as turning space, the engineer devised a guard that effectively stops cars, yet does not interfere with cars that use the gates for official business. Two posts, 10-in. scrap pipe, were set upright to flank the gates and provide stops against which they would open, as in the photo. The posts were filled with concrete and set in the same material to insure rigidity against being knocked over by any reasonable force.

In one of the posts, *P*, was placed a vertical shaft, to the top of which was welded the spindle from an automobile front-wheel assembly, carrying its two tapered roller bearings. A short length of pipe was tack-welded to the bearings. Across this unit, like an unevenly divided letter *T* was placed a length of extra-heavy 2½-in. pipe, more than long enough to span the gate posts. On the overhanging end beyond pivot post *P* was placed a counter-weight *C* so that the pipe was balanced at the pivotal point.

On the other post was set a shallow latch, with a steel loop, *L*, heavy enough to take any strain placed against the pipe. A similar stop, on the pivot-bearing post, served to limit the arc of swing of the bar when opened. Painted with aluminum, the bar is readily seen, even at night, and although bent several times by accidental impact, it has never failed to protect the gates behind it against damage.

Houston, Texas M T PATE

Methods Used to Bore Holes in Glass

BORING HOLES in glass may be quite a task, but I have found that simple equipment and a little know-how makes the job easy.

For small holes, I use an ordinary three-cornered file, such as is used to sharpen saws, with the flat sides ground to a sharp three-cornered point. Put some spirits of turpentine on the glass and rotate the drill under moderate pressure. Keep it wet with turpentine while cutting. An old receipt says dissolve camphor in the spirits of turpentine, but I find that drilling is satisfactory without camphor.

For large holes, use a piece of copper tube the size of the hole and rotate its end on the glass under moderate pressure, keeping the glass wet with fine emery and oil. To get best results drill holes from both sides letting them meet halfway through the glass. Keep the drill rotating freely and easily because pinching or jamming may break the glass. Finish the hole with a half-round or round file wet with turpentine.

An ordinary twist drill can be used to drill glass, but it must be ground with considerable clearance, both on the cutting edges and the circumference, because the least pinch may break the glass. Keep the drill wet with spirits of turpentine.

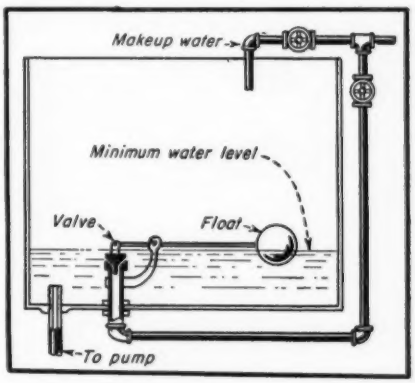
Atlanta, Ga. H P CLEARY

Float Valve Keeps Chemical Pumps Primed

BOILER FEEDWATER in our plant is chemically conditioned in a number of open tanks in which the different chemicals are dissolved. From these tanks the chemical solutions are injected into the feedwater line by proportioning pumps.

Normally a new batch of chemicals is added and the tanks refilled at the same time each day. Occasionally, we are delayed in filling the tanks for one or two hours. When this has happened the tanks may run dry and the pumps become airbound.

While this is not serious, it does take time to reprime the pumps just when other work is pressing for attention. To eliminate this difficulty I installed in each open tank a float valve like that in the flush box on a toilet and connected it to the water line, as in the diagram. Now, when the solution in the tank falls below a predetermined level, the float drops and opens its valve. The valve admits sufficient water to the tank to keep air from being sucked into the pumps, and keeps them primed for immediate use when the tanks are filled with chemical solution for the day's internal treatment of the boilers.



Glen Rock, N. J. A N MUSGRAVE

READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

Why Does One Cooling Tower Take More Air?

WE HAVE two cooling towers, each designed to cool 1300 gpm of water from 105 to 85 F with a maximum wet bulb of 79 F. One is an induced-draft tower and the other a forced-draft.

The induced-draft tower is 18 ft wide, 32 ft long, and 25 ft high. It is equipped with three 7-ft disk fans operating at 325 rpm. Each fan, which has a 7½-hp motor, produces 46,300 cfm of air at ½-in. of water static pressure.

The forced-draft tower is 20 ft wide, 36 ft long and 26 ft high. It is equipped with two 11-ft aluminum-alloy adjustable blade fans operating at 250 rpm. Each of these fans requires 15 hp and gives 120,000 cfm of air at ½-in. pressure.

Decking of both towers is the same. It consists of six sets of 1½x6-in. rafters with 1x3-in. strips of wood, spaced 2 ft. 3 in. apart and nailed on both sides of the rafters. Water is sprayed on the decking by 1½-in. nozzles at 5 psig.

I would like to know why the forced-draft tower requires about 72% more air and 30% more horsepower than the induced-draft tower.—*HB*

Answers to Questions

Will Motor Operate Below Normal Speed?

(This is Q 1 from August issue, with best answers from readers.)

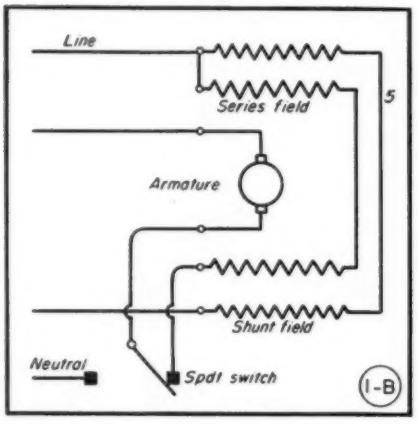
Our cooling system has a 6-blade propeller fan, 96 in. in diameter. It is powered with a 15-hp 240-v 1200-rpm dc compound-wound direct-connected motor. The field adjustment gives speed control from about 1100 to 2000 rpm, which is satisfactory for average conditions. On some days, however, the fan blows too much air. We have used a damper to control the air, but it isn't satisfactory.

I would like to operate the motor at slower speed, say, down to about 700 rpm. Our dc system is 120/240 v, 3-wire, so I thought we could operate on 120 v. When we tried it, the motor didn't work well, that is, it ran at about the same speed and had very little power.

Do POWER *readers know how to connect the motor so we can get speed adjustment from 700 to 2000 rpm without wasting a lot of power in resistors? I would like to see a connection diagram for rearranging our wiring.—RLG*

Use Dual Voltage

As RLG's DISTRIBUTION SYSTEM is 3-wire service, he can control the motor speed by changing impressed voltage for armature circuit without any elaborate control equipment. Sketch 1-*B* shows such a system and gives a distinct speed



of 600 rpm with better armature efficiency. Field-resistance control gives intermediate speeds up to 900 rpm.

Astoria, N. Y. CARL BACHMANN

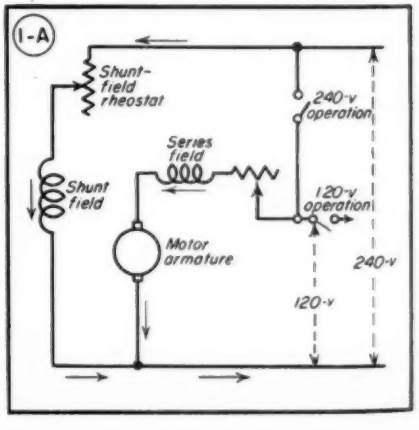
Two-Voltage Operation Gives Speed Control

IN ANY GIVEN MOTOR, torque is proportional to the armature current and to the strength of the magnetic field. Also, the speed of any given compound motor is a function of the design constants and is directly proportional to the generated voltage (back emf) and inversely proportional to the strength of the magnetic field.

RLG probably uses the field flux method for present speed control. This involves variation of shunt-field current by varying resistance in this field circuit. To obtain further speed adjustment, resistance may be inserted in series with the armature. Although effective, this method requires a heavy resistance to carry armature current. It wastes a large amount of power, and hence is inefficient.

I suggest that *RLG* use the 2-voltage scheme for further speed control since he has a 120/240-v supply available. This method applies either 120 or 240 v to armature terminals depending on which speed range he desires. Sketch 1-*A* shows connections.

The shunt field with its adjustable field rheostat should be connected permanently across the normal 240-v supply. For a range of 700 to 1500 rpm, armature would be connected across 120 v; for 1100 to 2000 rpm, across 240



v. Speeds between these limits for each armature connection may be obtained with a limited shunt-field control.

Tenafly, N. J. K B HOFFMAN

Connect Fields In Parallel

RLG's MOTOR will run below normal speed if a reduced voltage is available as indicated here. The fact that the motor runs badly at 110 v is largely the result of the reduced current in the field coils. This is not so noticeable in the armature because of its low resistance, but it is in the field where the resistance is high. If a motor is run with a greatly weakened field it usually brings the armature up to speed but it can not carry full load. This difficulty can be overcome by connecting the motor to the 110-v circuit and connecting the shunt-field coils in parallel instead of in series. Thus the current in the armature is reduced as a result of the reduced voltage, but the field coils remain at approximately the same strength. The motor runs below normal speed, but it can be adjusted as required by the field rheostat. It will take its normal load.

In Ireland I connected a motor to run in this way. The same results could be obtained by connecting the armature to the 120-v circuit and the field coils to the 240-v circuit.

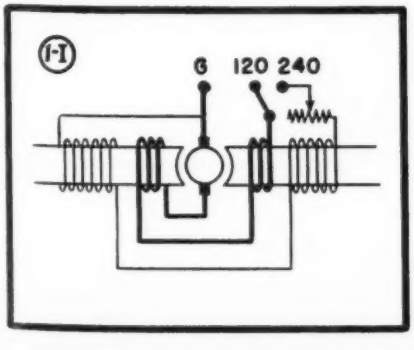
W E WARNER

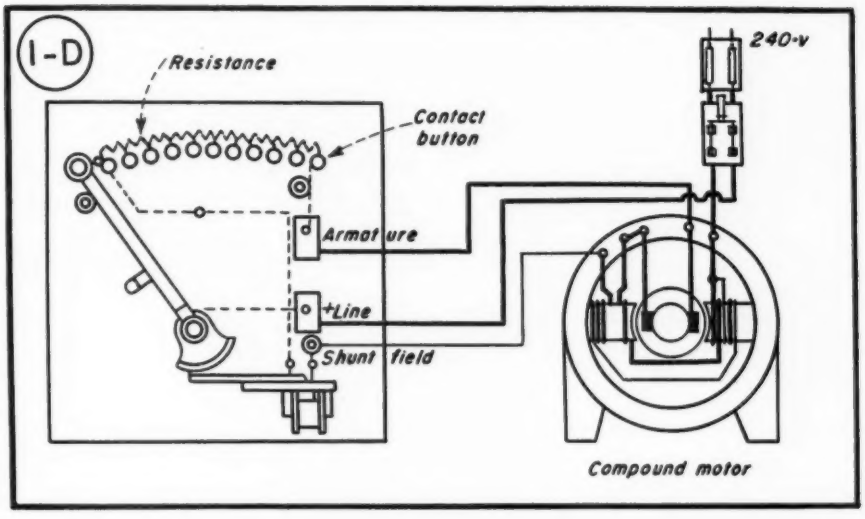
Woodford Green, England

Use Dual Voltage For Motor Control

TO LOWER THE SPEED of a compound wound motor to 700 rpm without using resistors and where 120/240-v dc is available, connect the armature-series field circuit to a switch, which allows alternate connection to either 120 or 240 v, as in sketch 1–*I*. The shunt field should be permanently connected to the 240-v line. When the switch is in the 240-v position the present field adjustment gives speed control from 1100 to 2000 rpm. With the switch to the 120-v side, the same control gives speeds of approximately 600 to 1000 rpm.

Allentown, Pa. P C SEATON



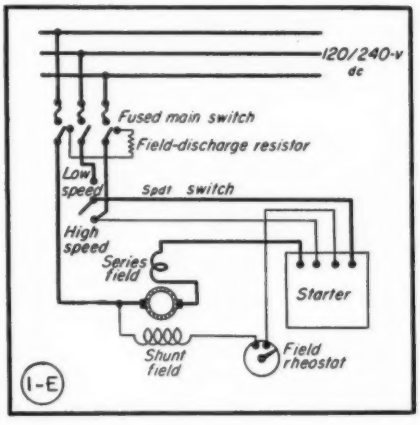


Armature Resistance Is Best Speed Control

IF A VARIABLE RESISTANCE is connected in series with the motor armature, sketch 1–*D*, a wide range of speed control can be obtained. The motor develops any needed torque because torque depends on flux and armature current.

With this method a portion of the armature power is lost in the series resistance and speed regulation is not too exact. The control resistance must have sufficient capacity for rated and overload current of the motor. *RLG* could use this method because it is cheap and readily applied. Since reduced speed is required only on certain days, total power loss would be small. Use of different voltages for speed control would be more expensive than the armature-resistance method.

New York, N. Y. T G HICKS



Three-Wire System Adjusts Speed

RLG WASN'T FAR OFF in trying to operate his fan motor at half voltage, but he should have left the field at full voltage. With a double-throw switch as in 1–*E*, he can go down to about 600 rpm.

In my old ICS *Electrical Engineer's Handbook*, under "Dynamos and Motors," I find the following:

"MULTIVOLTAGE SYSTEMS. A considerable variation of speed can be obtained by operating a motor on a three-wire system. The armature is connected to one side of the system to obtain half voltage for low speeds, and across the outside wires to obtain full voltage for high speeds. Intermediate speeds may be had by adjusting the field strength by means of a field rheostat. The changes in the connections can be made by means of a double-throw switch, the shunt field remaining connected across the outside wires. A few lamps connected across the shunt-field terminals will serve to take the field discharge when the main switch is opened."

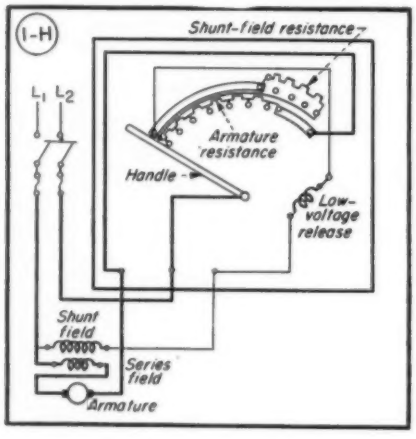
Duluth, Minn. G I SMITH

Use Armature and Field Control

TO SECURE SPEED CONTROL desired, buy a controller for combined armature and field control. This device is used where a greater speed control is re-

quired than can be obtained with field control alone. Armature control by itself is not economical for long use. Controllers for combined armature and field control are built in both drum and rheostat type as in sketch 1–*H*. With them the speed may be increased above normal by the field control and decreased below normal controlling armature current.

Power required to drive a fan varies as the cube of the speed so the current at low speeds is low, but some power is wasted in resistors. The problem is to reduce the armature current by means of a resistor for slow speed and



by rheostat in the shunt field to weaken it and increase the speed. These must be interconnected or interlocked for safety, so the motor cannot be started on a weak shunt field.

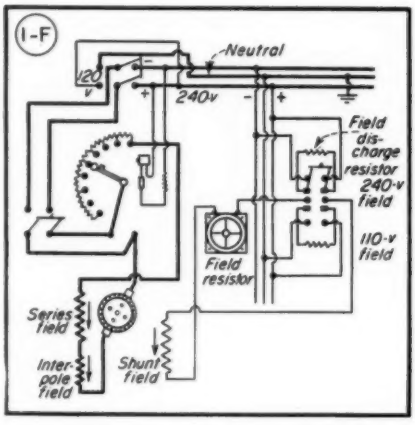
Carlsbad, N. M. E A Roberts

Use Reduced Voltage

Sketch 1–F diagrams a 120/240-v 2-pole switch for main armature line and another for the field. The shunt-field resistor has no interlock with main armature resistor to prevent starting with a weak field but with ordinary precaution this should not be necessary. Always start with shunt-field rheostat all out.

In tracing out the wiring diagram which is a 3-wire 120/240-v system we can use 120/240 v for armature or field. This in combination with shunt-field rheostat gives good speed variation without series resistor losses.

With 240 v on armature and field we get normal 1200 rpm. With 120 v on armature and 240 v on field 300 rpm would result. With 240 v on armature and 120 v on field speeds much higher than 2000 rpm could be obtained because of field weakening. In this case



several speeds could be obtained with variation between them by use of field rheostat.

Ottawa, Ont. J Bongiorni

Reduce Armature Voltage

If RLG's motor is connected as in 1–*G* he should obtain the speed he desires. Both the field and the low-voltage release coil are always connected to 240 v. The armature can be connected to either 120 or 240 v. The normally closed switch actuated by the starter arm must be capable of interrupting field current.

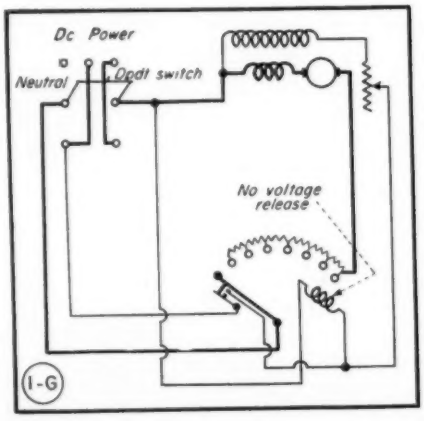
From the following equation:

$$E_t = K\varphi n + I_aR_a$$

where

E_t = applied voltage
$K\varphi n$ = counter emf
K = constant for a given machine
φ = total flux per pole
n = rps

it is obvious that a reduced applied voltage to both armature and field results in a reduced flux per pole to half normal. Therefore speed remains unchanged if the equation balances. By similar reasoning if the flux is unchanged and the armature voltage reduced to 120 v, speed is cut in half.



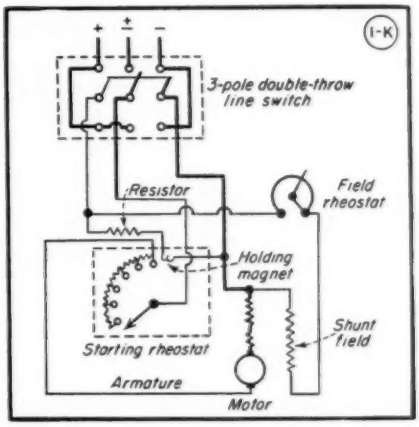
I_aR_a, which is less than 10% of E_t, can be neglected here.

Hamilton, Ont. J A Coulden

Use 3-Pole Switch To Transfer Voltages

Because the motor developed little power when operated on 120 v, it is evident that both the field and armature were connected to reduced voltage. This gives a weak field with a corresponding reduction in torque.

With the field connected to 240 v using the same field rheostat, and the



armature connected to 120 v, speed range should be one-half that on 240 v, or 550 to 1000 rpm. Speed changes can be made with a specially designed drum controller, but can also be handled more easily by using a 3-pole double-throw knife switch. Connections are shown in 1-*K* with separate starting and field rheostats. If a combined starting and speed-regulating rheostat is used it is impossible to start the motor with a weak field.

Altoona, Pa. A R Markland

Vary Speed by Reduced Voltage

Speed of a compound motor can be varied by either armature or field control. When range of speed adjustment possible with field control is not sufficient, voltage impressed on armature may be varied to meet requirements with constant field voltage. With this arrangement, speed for a given load is about proportional to impressed voltage on the armature.

When a 3-wire 120/240-v dc supply is available, the armature voltage may be halved simply by connecting it across the 120-v side. If normal motor regulation is from 1100 to 2000 rpm, with

(*Continued on page* 148)

What Is Best Program of Pump and Motor Repair?

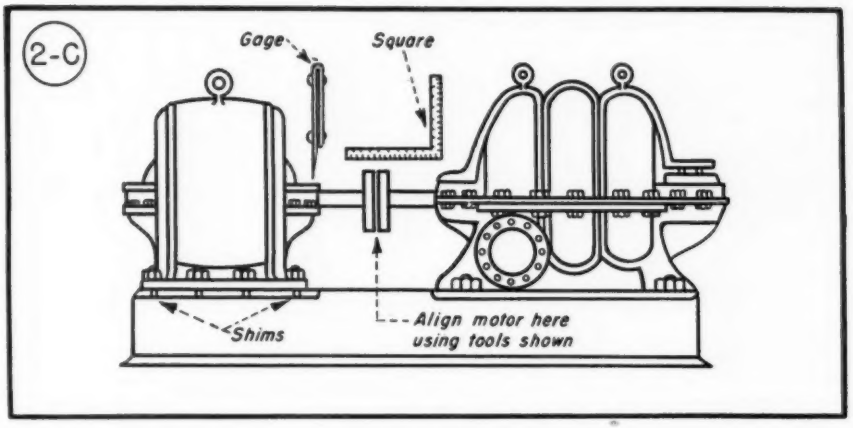
(This is Q 2 from August issue, with best answers from readers.)

OUR SYSTEM *has a large number of motor-driven centrifugal pumps, ranging from 6 to 10 in. in size. These pumps circulate water through gravity and pressure filters.*

At certain times, we have a chance to overhaul the equipment. In the past, when we disassembled a pump, the electrician would come in and work on the motor. If the motor had to be disassembled, we took the pump impeller and shaft out so the motor remained on its base. On several occasions, we have torn a pump down just to work on the motor. On some of these overhauls, new bearings were installed in the motors, and the units were reassembled without aligning the shafts. This makes excess wear in pump bearings, which causes vibration.

Because I am in charge of pump repair, I have opposed this procedure. It is impossible to shift the pump to line up with the motor. I argue that the motor should be moved when it is dismantled, or alignment is necessary.

I would like POWER *readers to explain how jobs of this kind are handled in their plants so I can use their methods as arguments for changing our arrangements. If any one has a schedule or program of maintenance work, it would also be helpful. Do you agree it is easier to shift the motor?—DBD*



Adjust Motor to Fit the Centrifugal Pump

FROM 30 YEARS' EXPERIENCE I say *DBD* is right when he claims the proper method is to line up the motors to the pump. We have several large motor-driven centrifugal pumps, and when we repair the motors, we never dismantle a pump. The only time we open a pump is to change the impeller or for inspection. After an inspection the motor is lined up again to the pump as illustrated in sketch 2-*C*, above.

As *DBD* says, it is hard to line the pump up to the motor. What happens to intake and discharge pipelines? Motors are set up so they can be moved for the purpose of alignment. If unit runs out of alignment it causes excess wear and hot bearings. Yes—shift the motor, not the pump.

Sault Ste. Marie, Ont. A J SMITH

Keep Maintenance Index

HARD-AND-FAST RULES on pump and motor maintenance can be laid down only by *DBD* himself after actual experience has shown how long each pump can be expected to run before routine inspection is necessary. After overhaul, to replace motors in service without lining up with the pump is asking for trouble, particularly when new motor bearings have been fitted. If a master mechanic is responsible for the pumps, and an electrical foreman for the motors, it is essential that they cooperate in scheduling routine examinations for the whole unit.

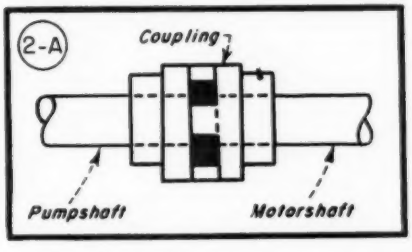
The efficiency of a preventive-maintenance program depends largely on a good simple card-index system. Sketch 2-*B* shows one type of card.

As to *DBD's* problem of lining up, it is general practice to line up the motor with the pump, rather than the pump with the motor. Routine examinations and maintenance do not call for frequent moving of the pump casing, whereas for a motor the rotor has to be moved from the stator. The motor is often the only thing to move.

Dolbeau, Que. R A LANE

Use Flexible Couplings

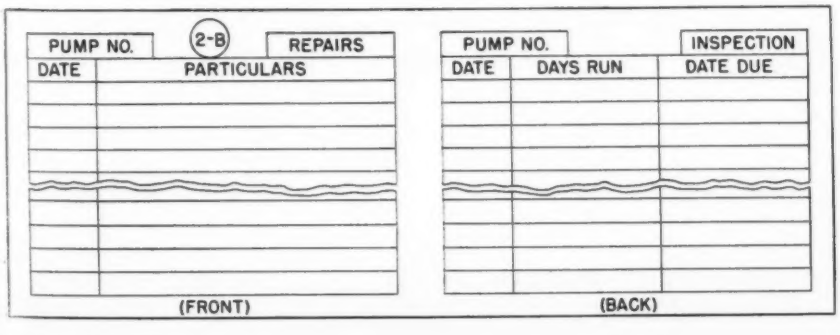
DBD CAN EASILY ELIMINATE his alignment trouble by using one of the many types of flexible couplings. In our plant all centrifugal pumps use the split shaft and flexible coupling, sketch 2-*A*. Coupling is in two parts. One



half is keyed to the motor shaft by setscrews and the other half to the pumpshaft. Shaded section is hard leather.

By using these couplings either motor or pump can be worked on without disturbing the other. Alignment of motor and pump is also a simple process. Bearing replacement is less frequent and a better maintenance schedule can be worked out.

Baltimore, Md. C D PRICE



Keep Permanent Records

MAINTENANCE SCHEDULE in our small plant calls for a weekly check of all motors and pumps. We oil and refill grease cups once a week. Every few months each motor is torn down and thoroughly

(*Continued on page* 150)

ROTARY-PUMP Q&A FOR POWER ENGINEERS

By A M SHAW

2—Heads, Capacity, Power and Selection

Second of a series in which A M Shaw, application engineer, rotary pump division, Worthington, selects questions and answers that give a practical understanding of construction, operation, characteristics, troubles and remedies.

Q 1—How is head on a rotary pump expressed?

A—Head on a rotary pump and other positive-displacement pumps is usually expressed in pounds per square inch (psi) or in inches of mercury vacuum on the inlet side if the unit is subject to a suction lift.

Q 2—How may head expressed in feet be converted to pressure (psi), or vacuum changed to inches of mercury?

A—Heads expressed in feet can be converted to pressure (psi) by multiplying the head in feet by 0.434 and then multiplying the result by the specific gravity of the liquid. Suction lifts in feet can be converted to inches of vacuum (mercury) by multiplying the lift in feet by 0.885, and then multiplying the result by the specific gravity of the liquid.

Q 3—What is vapor pressure?

A—Vapor pressure of a liquid at a given temperature is that pressure at which it flashes into vapor if heat is added.

Q 4—What is viscosity?

A—Viscosity is that property of a liquid that resists any force tending to produce flow.

Q 5—What is meant by ssu?

A—The commonest measure of viscosity in the U. S. is in saybolt seconds universal (ssu). This is the time in seconds required for 60 cc or ⅛ pint of the liquid to flow through a tube 0.0695 in. inside diameter and 0.481 in. long, Fig. 2. The higher the ssu rating, the more viscous the liquid. Cold water has a viscosity of 31 ssu, No. 2 fuel oil 55 ssu, and No. 5 fuel oil may have a viscosity as high as 8000 ssu at 70 F.

Q 6—What effect does temperature have on liquid viscosity?

A—Increasing the temperature reduces the viscosity of most liquids and, conversely, a reduction in temperature increases the viscosity.

Q 7—What effect does viscosity have on pipe friction?

A—The resistance to flow or pipe friction through the system varies directly as the viscosity of the liquid. That is, if the viscosity increases, pipe friction also increases, and vice versa.

Q 8—Why is it necessary to consider pipe friction in a pumping setup?

A—Because pressure, required to overcome the friction of liquid flow through discharge and suction pipe, valves and fittings, must be added to the static head to obtain the total head on the pump.

Q 9—What is most important consideration in pumping viscous liquids?

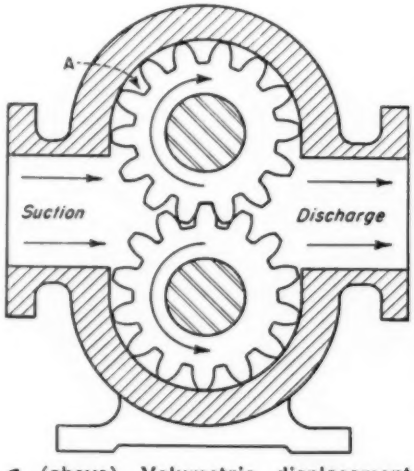
A—To calculate the suction-pipe friction. Though there may be a static head on the suction of a rotary pump, often the suction-pipe friction is enough to nullify such a head and create an impossible suction lift condition. Rotary pumps have excellent suction qualities but will not do the impossible. Remember that on a suction lift, atmospheric pressure 14.7 psi (absolute) is all that is available to push liquid into the pump.

Q 10—What is the displacement of a rotary pump?

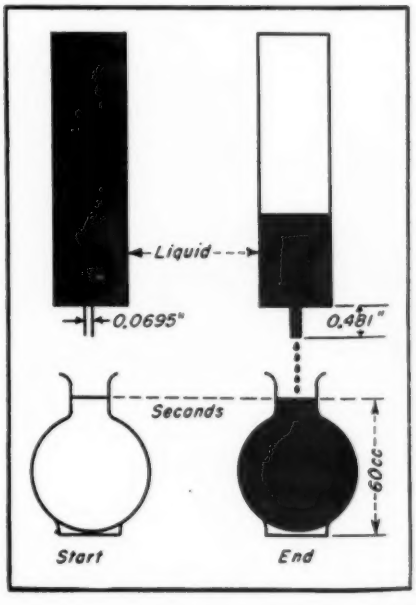
A—It is the theoretical quantity that the rotating elements displace under no head or pressure conditions. In a gear pump, for example, displacement is the sum of the volumes represented by the space between all the gear teeth. In Fig. 1, the pump has 28 spaces between its gear teeth; therefore the pump's displacement in one revolution is the space volume between two teeth, as at *A*, times 28.

Q 11—What is slip?

A—It is the quantity of liquid that escapes from the discharge back to the



1 (above) Volumetric displacement of gear rotary pump is the volume of space between a pair of teeth, as at A times number of teeth in both gears



2 (right) Ssu viscosimeter, the commonest U. S. measure of viscosity

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C-H Magnet on crawler type crane built by Unit Crane & Shovel Corp.

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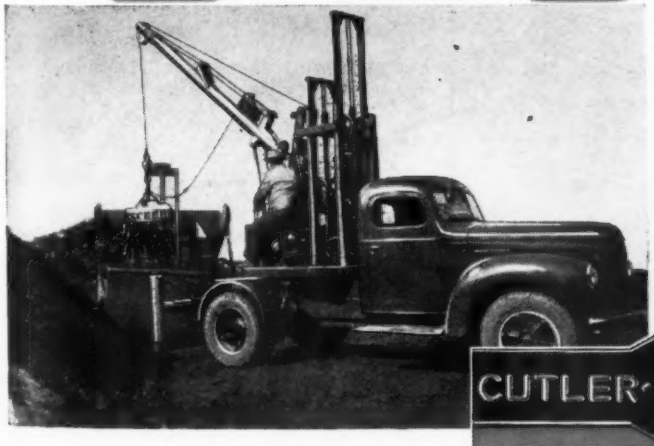
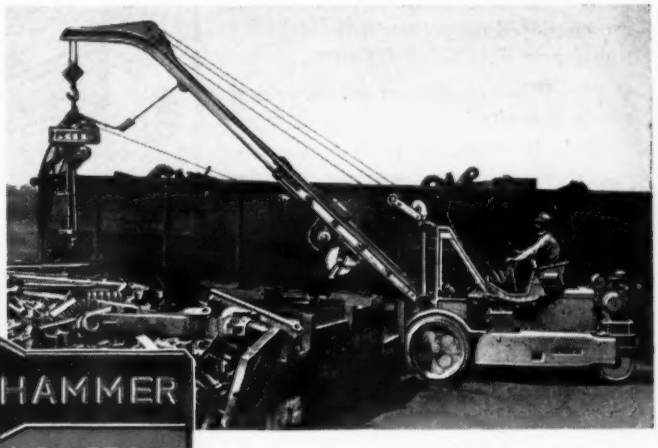


C-H Magnet on Milwaukee Hydraulics Corporation's mobile crane handles iron and steel anywhere in scrap yard.



C-H Magnet on Silent Hoist & Crane Co.'s "KRANE KAR" transfers scrap to rail cars.

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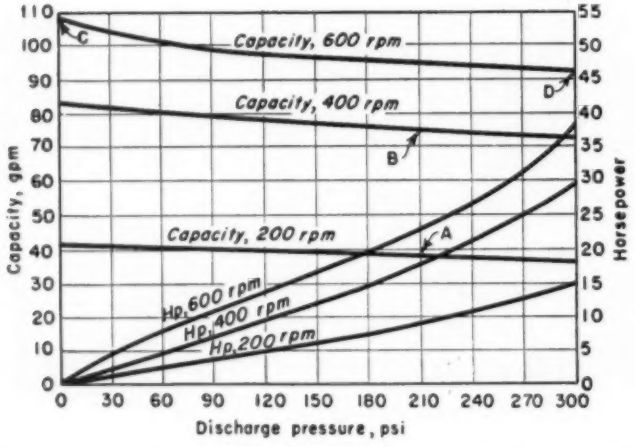
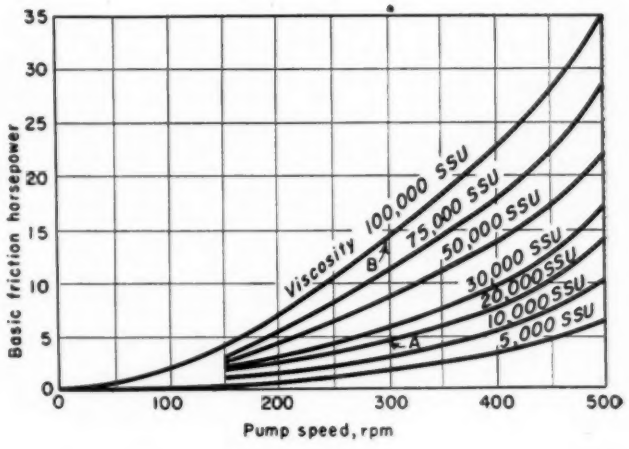


3 Capacity and horsepower performance curves of a gear rotary pump handling heavy oil at 200, 400, 600 rpm



4 Curves show how basic friction horsepower varies with changes in the liquid's viscosity and the pump speed

suction through the normal clearance spaces between the rotating elements and between the elements and casing under operating pressure conditions. In Fig. 5 leakage occurs between the gear teeth as at *A*, between the ends of the gears and the casing at *B*, and between the face of the teeth and the casing at *C*. Liquid that escapes through these spaces back to the suction represents the pump's slip.

Q 12—What is meant by capacity of a rotary pump?

A—Capacity is the actual quantity of liquid, usually expressed in gpm delivered under specified conditions.

Q 13—What units are used for rotary-pump capacity?

A—Designers in this country rate their pumps in U.S. gallons per minute. Those in Great Britain use imperial gallons per minute. Cubic meters per hour are used in countries employing the metric system. Many other units, such as barrels per hour, pounds per hour, cubic feet per second, are employed on process or bulk liquid transfer work.

Q 14—What conditions affect rotary-pump capacity?

A—It is necessary to state the viscosity, pumping temperature, suction and discharge-head conditions, nature of the liquid and amount of entrained or dissolved air or gas before the manufacturer can guarantee pump performance. All these conditions have some effect on pump capacity. If the pump is to be driven by motor, gear motor or other constant-speed prime mover, it is well to state what range in capacity is permissible. Then, the manufacturer can select the nearest size standard pump and state what capacity it will deliver under stipulated conditions.

Q 15—What are the characteristics of a rotary pump?

A—A rotary pump displaces a positive quantity of liquid each revolution. Therefore, its displacement varies directly as the speed, except as capacity may be affected by viscosity and other factors. Fig. 3 shows capacity and power curves of a gear pump handling heavy oil at 200, 400 and 600 rpm. Capacity (75 gpm) at 210 psi and 400 rpm, point *B*, is about double that (38 gpm) at the same pressure and 200 rpm, point *A*. Because the heavy oil cannot flow into the pump fast enough to keep it full at the higher speeds, pump capacity did not increase as much from 400 to 600 rpm as from 200 to 400 rpm.

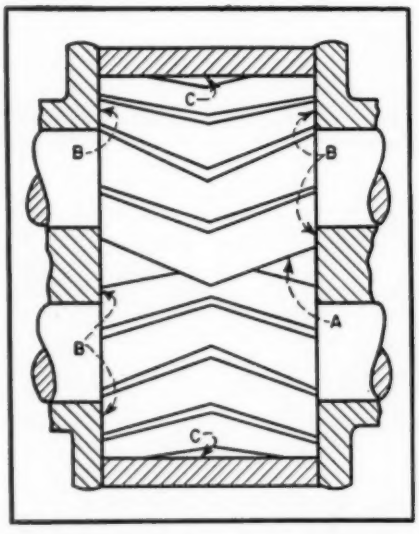
Slip or loss in capacity through clearances between the casing and rotating element, assuming a constant viscosity, varies as pressure increases. For example in Fig. 3, pump capacity is 108 gpm at zero pressure and 600 rpm, point *C*. At 300 psi, and the same speed, pump capacity drops to 92 gpm, point *D*. That is, as pump pressure increases from 0 to 300 psi its capacity decreases from 108 to 92 gpm.

Fig. 3 also shows how horsepower to drive the pump increases directly with pressure and speed. Power required at a given speed and pressure increases with viscosity. At zero pressure the pump requires driving power simply to move the rotating elements through the liquid. This power, which has been referred to as the basic friction horsepower, must be added to the power for the hydraulic load and that wasted in slip to obtain total power required to drive the pump.

Fig. 4 shows how the basic friction horsepower varies with changes in viscosity and pump speed. For example, at 300 rpm and a 20,000-ssu liquid, the basic friction horsepower is 4.5, point *A*. With a 100,000-ssu liquid and 300 rpm the basic friction horsepower is 14, point *B*. At 300 rpm and 20,000 ssu the basic friction horsepower is 4.5, point *A*, but at 450 rpm and the same viscosity, power increases to 10 hp.

Q 16—For what services are rotary pumps recommended?

A—They are well suited to viscous, nonabrasive liquids that do not corrode their parts. Pressure limitations are usually maintained below 1000 psi although some designs are suitable for higher pressure when handling lubricating oils. Because of their ability to handle low-viscosity voltatile liquids, with suction-lift conditions often approaching vapor-pressure points, rotary



5 Leakage, between gears at A, between gear ends and casing at B, and between gear teeth and casing at C, is a measure of the pump's slip

Wide Acceptance!

Though introduced only recently, thousands of Yarway Remote Liquid Level Indicators already have been bought . . . and the list of satisfied users reads like a Who's Who of Industrial Plants, Utilities and Institutions.

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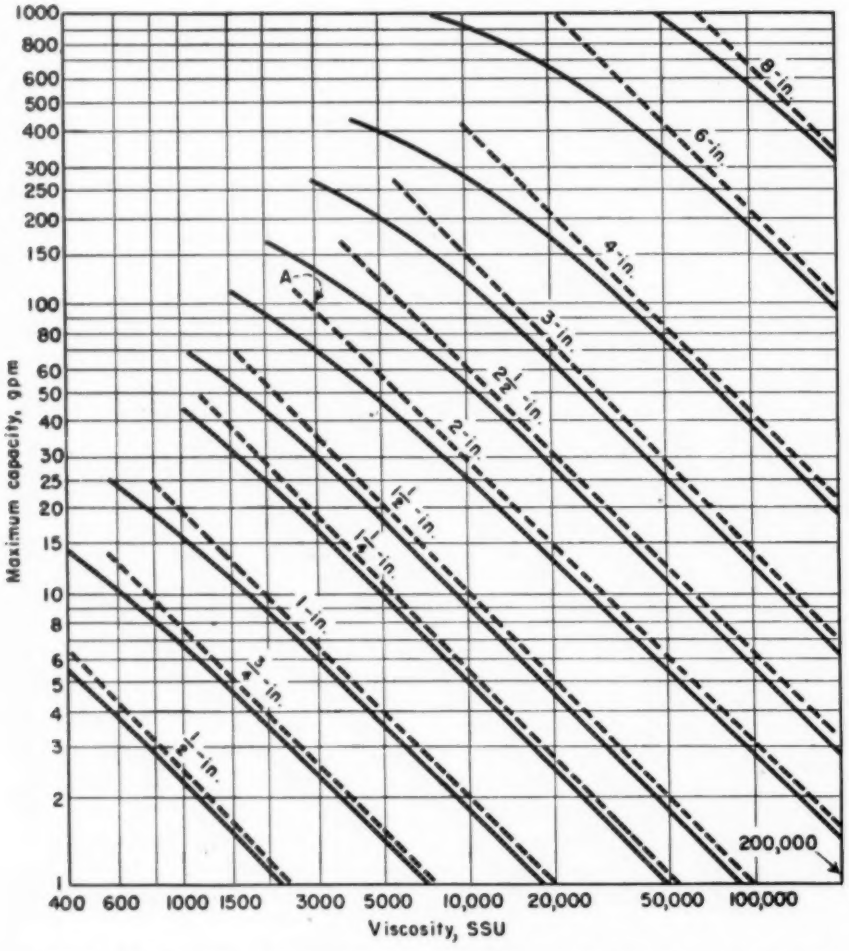
YARWAY REMOTE LIQUID LEVEL INDICATOR



6 Maximum capacity recommended through different-size suction pipes depends on liquid's viscosity. Solid lines represent 10 ft of straight steel pipe with two elbows; dotted lines, 10 ft of straight steel pipe with no fittings

pumps are frequently used on such liquids for intermittent duty.

Q 17—Are rotary pumps self-priming?

A—In general they are. It is advisable to prime a pump when it is first started and not allow it to run dry.

Q 18—What effect does elevation above sea level have upon rotary-pump performance?

A—Elevation above sea level decreases atmospheric pressure about 1 in. of mercury per 1000 ft elevation. If suction-lift condition is such that a reduction in atmospheric pressure might reduce absolute suction pressure to near the liquid's vapor pressure, make allowance for this when determining whether the liquid will vaporize and cause reduced pump capacity and cavitation.

Q 19—What is the effect of cavitation on a rotary pump?

A—It causes noise and vibration in the pump as bubbles are liberated and collapse against the rotating elements. This action results in a gradual falling off in capacity as the suction lift is increased. Shape of the pump's capacity curve depends on vapor pressure of the liquid and amount of entrained air or gas in it.

Q 20—What effects do entrained air and vapors or dissolved gases in the liquid have on rotary pumps?

A—If suction pressure is below atmosphere, entrained air and vapors or dissolved gases will be liberated as bubbles, which expand as the suction increases, taking more and more space until they occupy practically all the space in the pump when it fails to discharge.

Q 21—Will a rotary pump lose its prime if subjected to high suction lift and bubbles in the liquid?

A—No, it should not under these conditions unless it runs dry, or is badly worn.

Q 22—Does suction lift affect the efficiency of a rotary pump?

A—No, unless it is great enough to cause the liquid to vaporize, or to liberate air or gas, thereby reducing pump capacity.

Q 23—Can the size of suction pipe affect rotary-pump capacity?

A—Yes. If this pipe is too small, friction losses plus static lift may produce a total suction lift greater than the liquid can stand. Liquid vaporization or liberation of bubbles will reduce pump capacity. Fig. 6 shows how maximum capacity recommended for different-size suction pipes depends on the liquid's viscosity. Solid lines represent 10 ft of straight steel pipe with two elbows. Dotted lines represent 10 ft of straight steel pipe with no fittings. To find the size of pipe follow horizontally from the desired capacity, say 100 gpm, and meet the vertical line up from viscosity; assume 3000 ssu, point *A*. Use the size suction pipe indicated above this point, which is 2½ in, provided the suction pipe is not over 10 ft long, the liquid is nonvolatile and there is no static suction lift.

Q 24—How does viscosity affect rotary-pump efficiency?

A—Shape of the pump's efficiency-viscosity curve for a fixed pressure depends on the pump design and its relative speed. In general increased viscosity reduces efficiency.

Q 25—Why is it so important to consider viscosity with rotary pumps?

A—It is no more important than with other types. Rotary pumps are used extensively for highly viscous liquids and their brake horsepower increases with increased viscosity.

Q 26—What effect does viscosity have on pump selection?

A—As the viscosity increases it is necessary to reduce pump speed to allow more time for the liquid to fill the spaces in the rotating elements. Therefore a larger, slower speed pump would be selected for more viscous liquids than for thin liquids.

Q 27—How does a liquid's temperature affect rotary pump selection?

A—All iron designs are generally used for temperatures up to 450 F. Above that temperature steel casings are recommended. Water-jacketed stuffing boxes are available to protect the packing above 350 F.

Q 28—Can rotary pumps be used for liquids which solidify at atmospheric temperatures?

A—Steam-jacketed pumps are used so such materials may be melted in the pump before starting.

(*Continued on page* 158)

Oil Consumption Cut 10%

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Used in Six Diesels in Big Eastern Power Plant, Keeps Rings Free in Steady Day-and-Night Operation

A well-known heavy-forging plant operates six Diesels. Running side by side, the engines furnish an ideal testing ground for Diesel oils. A well-known brand of oil was being used when, a few years ago, tests were made on a Sun "Job Proved" Diesel lubricant.

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MATH TIPS

PHIL SWAIN GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS

How to Figure Leverage: II

▶ LAST MONTH WE COVERED some common examples of leverage—a crowbar lifting a rock, a bellcrank lever, and a beam used to divide a 3-ton load between a fixed support at one end and a hoist at the other.

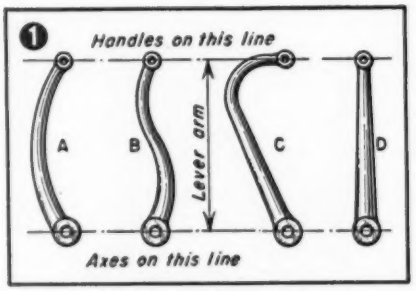
More Force, Less Distance. There were two main points. First, any lever, or other device to multiply force, does so at the expense of distance. Even a lever doesn't give you something for nothing; it doesn't deliver any more work than is fed into it.

But a lever does convert work into more convenient form. For example, a man isn't strong enough to lift a certain heavy rock, so he uses a long easy stroke on a crowbar to lift the heavy rock a much shorter distance.

In general, neglecting friction, a lever or other force-multiplying device divides the distance as much as it multiplies the force. For example, if the lever arms are 4 to 1, the force is multiplied by 4, and the input movement is divided by 4, so the work output equals the work input.

We now come to an important subject; you might call it "true lever arms" or "invisible lever arms," since often the true lever arm is not the same as the metal rod that appears to be the lever arm.

Old Oaken Bucket. Let's start off with an example that fooled grandfathers, although it never did fool nature—the curved handle on the windlass that wound the old oaken bucket out of the well. The first man who curved a pump windlass crank was trying to cheat the laws of levers, to get the water up with less work. It was a fraud—probably an innocent fraud.



1 Curving the pump handle fooled grandfather, but didn't fool nature. Trick curved handles A, B and C act just like straight handle D of same length (axis to center of handle)

The curved handle works exactly as easy, and as hard, as a straight handle with the same center-to-center distance from axis to handle. In Fig. 1 the fancy curves *A*, *B* and *C*, work out exactly the same as *D*, except for the eye appeal and the extra cost for metal and patterns.

Note, however, that the radius of the crank is the true lever arm only when the push is in the direction of motion—that is, along the tangent of the circle of rotation, or at right angle to the radius from the center of rotation to the point where the force is applied to the lever.

Angular Pulls on Levers. If the force is applied in any other direction the length of the lever arm is reduced and becomes the perpendicular dropped from the center of rotation to the line of action of the force, extended.

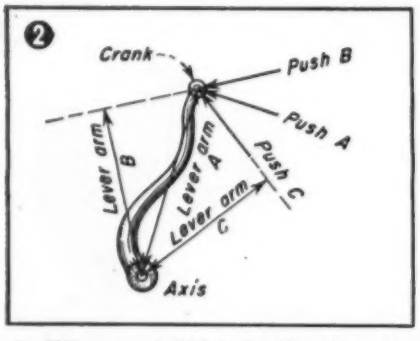
Fig. 2 shows the true crank arm for various directions of push, and makes clear why the greatest leverage is obtained when the push is in the direction of motion.

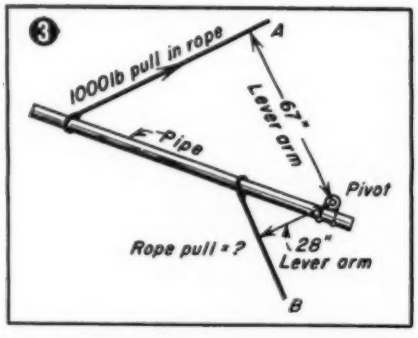
Fig. 3 shows an arrangement of pipe and two ropes to multiply force in some special situation where right-angle pulls were not possible. Dropping perpendiculars from the pivot to the lines of pull, we find that the 1000-lb pull of *A* acts at a lever arm of 67 in., and the resulting pull on *B* at a lever arm of 28 in. Dividing 67 by 28, we see that the pull-in must be 2.4 times that in *A*, or 2400 lb.

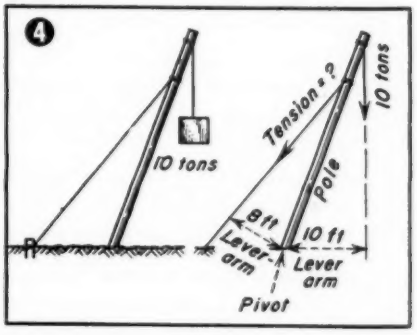
Gin Pole and Guy Rope. Fig. 4 shows a very practical application of this rule, because the guy rope must be strong enough to carry the load. Every rigger knows that the guy should be well back from the pole to avoid excessive tension.

The reason for this is made clear in the second sketch. We have here a lever pivoting about the point where the pole rests on the ground. Measuring at right angles, we see that the guy rope operates at lever arm of 8 ft and the load at a lever arm of 10 ft, so the tension in the rope will be 10/8 of 10 tons, or 12.5 tons.

It is clear from this sketch that the tension in the guy rope will exceed the weight lifted if the perpendicular distance from the pivot to the guy is less than the horizontal distance from the pivot to the line of the load.







2 When push (A) is in direction of motion, the true lever arm is radius from center of rotation to point of application of force. When push is tilted (B or C) lever arm is shortened and becomes length of perpendicular dropped from rotation center to line of push projected.

3 Rope A pulls 1000 lb on pipe as indicated. What is resultant pull in rope B? Perpendicular from pivot gives A a lever arm of 67 in., B a lever arm of 28 in., so tension in B is 67 ÷ 28 = 2.4 times that in A, or 2400 lb.

4 Gin pole is lever. Here 10-ton load operates with 10-ft lever arm, guy rope with 8-ft lever arm, so tension in guy rope is 10/8 of 10 tons = 12.5 tons.

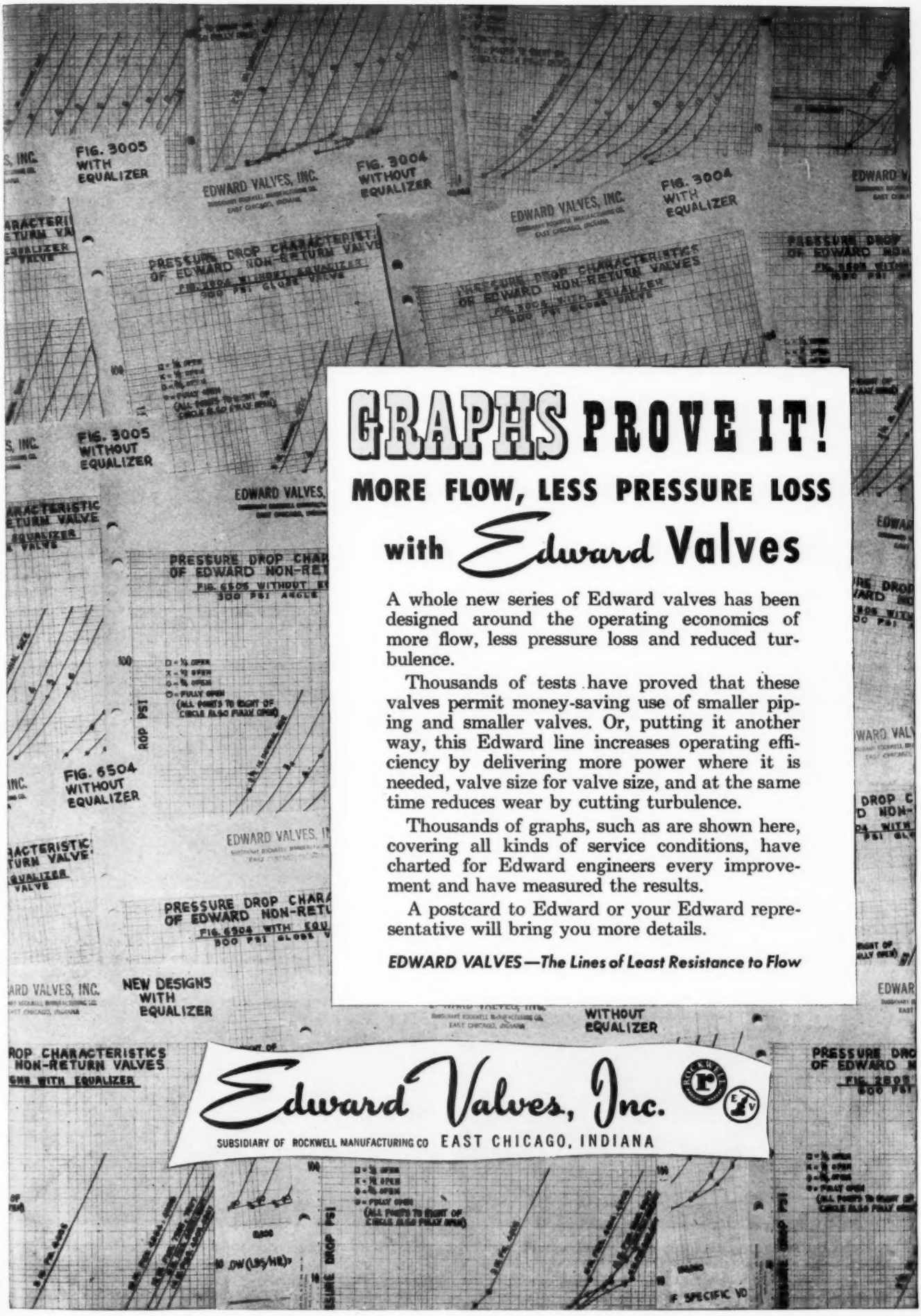


FIG. 3005 WITH EQUALIZER
EDWARD VALVES, INC.
FIG. 3004 WITHOUT EQUALIZER
EDWARD VALVES, INC.
FIG. 3004 WITH EQUALIZER
PRESSURE DROP CHARACTERISTICS OF EDWARD NON-RETURN VALVES
FIG. 3004 WITHOUT EQUALIZER
300 PSI GLOBE VALVE
FIG. 3005 WITHOUT EQUALIZER
FIG. 6504 WITHOUT EQUALIZER
PRESSURE DROP CHARACTERISTICS OF EDWARD NON-RETURN VALVES
NEW DESIGNS WITH EQUALIZER
WITHOUT EQUALIZER
PRESSURE DROP CHARACTERISTICS OF EDWARD NON-RETURN VALVES
FIG. 6504 WITH EQUALIZER
300 PSI GLOBE VALVE
PRESSURE DROP PSI
SPECIFIC VO

GRAPHS PROVE IT!

MORE FLOW, LESS PRESSURE LOSS

with *Edward* Valves

A whole new series of Edward valves has been designed around the operating economics of more flow, less pressure loss and reduced turbulence.

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Thousands of graphs, such as are shown here, covering all kinds of service conditions, have charted for Edward engineers every improvement and have measured the results.

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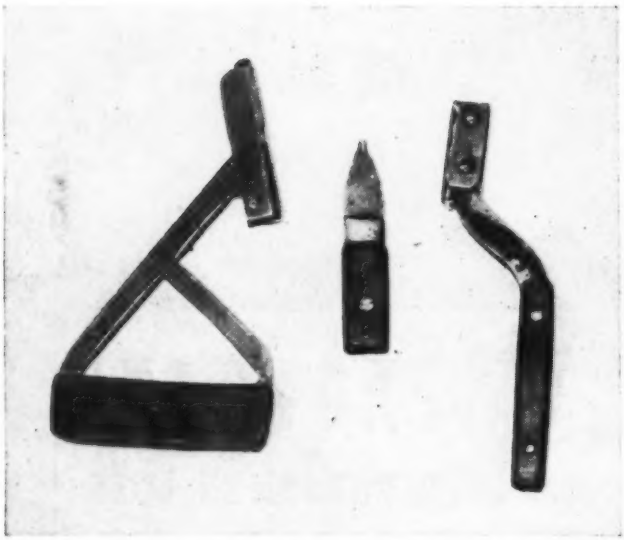
EDWARD VALVES—The Lines of Least Resistance to Flow

Edward Valves, Inc.

SUBSIDIARY OF ROCKWELL MANUFACTURING CO EAST CHICAGO, INDIANA

HOW TO UNDERCUT A COMMUTATOR



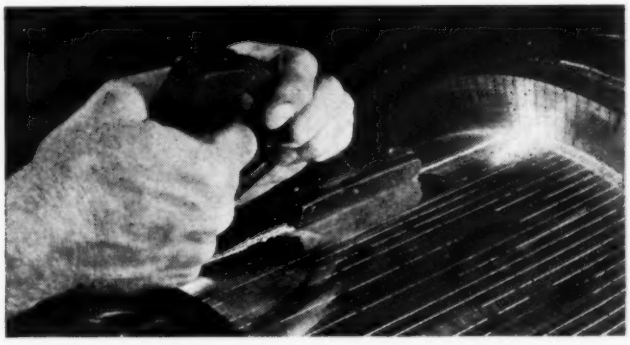
1 Undercutting tools consist of a convenient clamp with handle that grips a section of a common hacksaw blade with sides of teeth ground off. Depth that the slot is to be undercut is set by distance the blade projects from holder. Knife is ground down to a point with concave section that trims square edges of the bars.

►AN IMPORTANT PART of armature maintenance is undercutting of commutators. The main purpose is to lower the mica below the surface of the bars. Since copper generally wears faster than mica, the bars soon drop below the mica. This causes the bars and brushes to burn because of improper contact and vibration. Here is a step-by-step description of a simple method of undercutting a commutator by hand.

—Courtesy of General Electric Co

4 With groove started, continue cutting until the approximate depth of cut is made. This requires several passes of the tool. Take care not to let it slip and thereby groove the smooth surface of the commutator bars.

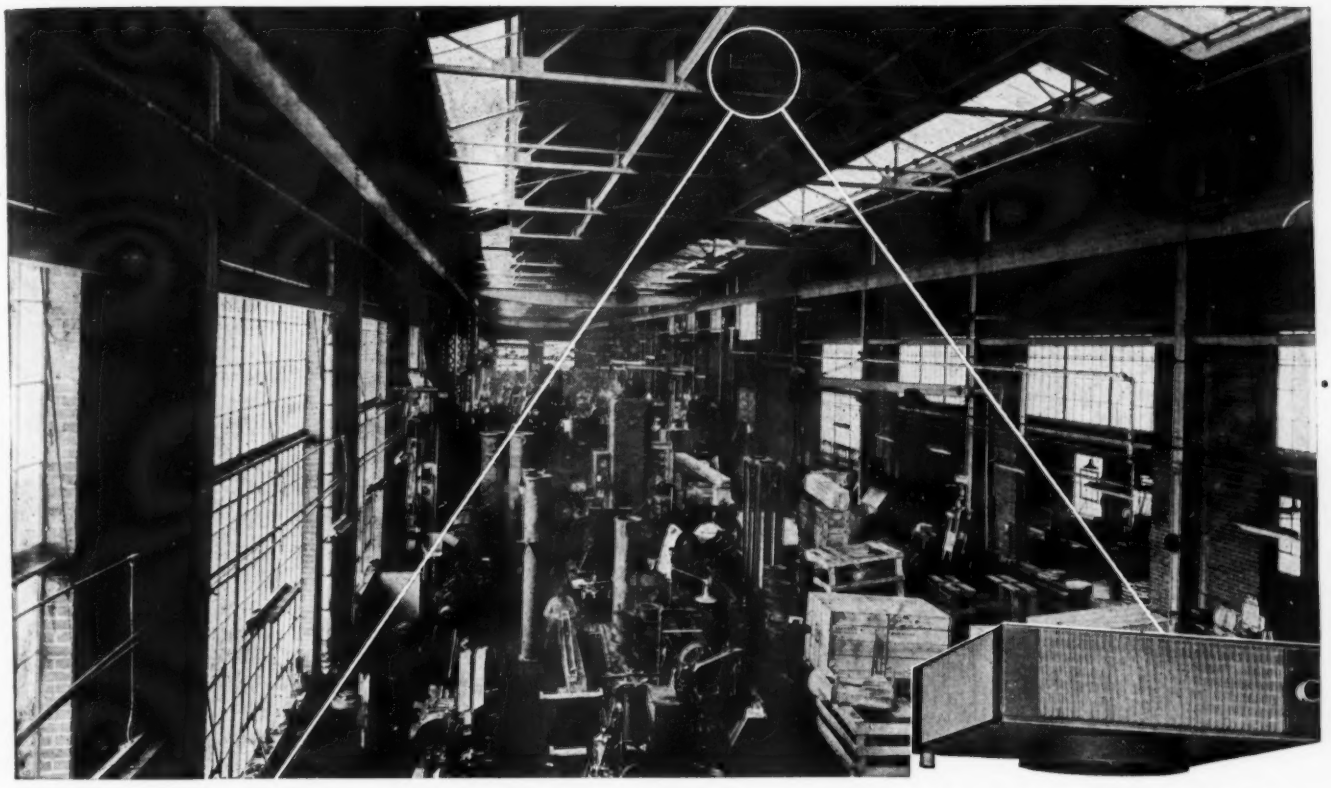
2 Start the undercut by setting the saw on the outside corner of the commutator at an angle, as shown above. Draw tool backward—with the teeth—several times, the same as in starting a crosscut handsaw on a board.



5 When the slots are all cut down to the approximate depth, take the larger tool and cut them to correct depth. Then tilt the tool to each side as shown above to remove the side mica and to insure cutting a square slot.

3 After the start of undercut is made, level tool off slightly. Continue working back and forth until the groove is started between the two bars. Hacksaw blade should be set to project the correct depth of the slot.

6 After all slots have been cut correctly, take a chamfer knife and shave the square edge from commutator bars. When slots have been properly undercut and chamfered, polish the commutator surface with fine sandpaper.



Main Building, Schutte & Koerting Co. Cornwells Heights, Pa.

Length, 560 feet; width, 48 feet; height, 45 feet. Heated by Webster-Nesbitt Little Giant Down-Blow Unit Heaters. Consulting Engineer—the late Charles A. Blatchley, Philadelphia. Heating Contractor—Gray & Dormer, Philadelphia, for the present installation; Warren J. Cathcart Philadelphia, for the plant extension now under construction.

Problem Solved with these Unit Heaters

In 1944, Schutte & Koerting Co., manufacturing engineers for the power and process industries, sought a means to eliminate shortcomings in the steam heating system of their Cornwells Heights plant.

Because of the high ceilings with skylights and the long narrow manufacturing bay with large windows on both sides, difficulties had been experienced and the men had complained of uncomfortable working conditions and lost time due to frequent colds.

After full study, a decision was reached to modify the steam heating system and install Webster-Nesbitt Little Giant Down-Blow Unit Heaters above the crane runways and approximately 40 feet above the ground. Care was taken to determine the proper size, spacing and discharge velocity of these units.

After more than two heating seasons of operation, here are the results according to Winfield Beals, plant superintendent:

The heated air leaves the unit heaters at high velocity, diminishing at the working level so that the air spreads out to provide comfort in the working zone. The units are placed so that the effective heat circles overlap each other. No "cold corners."

In the workmen's dressing room and in the stock room, Webster-Nesbitt Propeller-Fan Unit Heaters are used, providing a degree of comfort not previously experienced.

All of the Webster-Nesbitt Unit Heaters used in the Schutte & Koerting plant are supplied with low pressure steam and equipped with Webster Float and Thermostatic Drip Traps and Strainers.

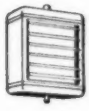
In the new plant extension recently completed, Schutte & Koerting Co. followed a similar program to provide like results.

If you are experiencing difficulty in heating your plant to the full satisfaction and comfort of your employees, perhaps an engineered application of Webster-Nesbitt Unit Heaters and other related Webster Equipment may provide a solution.

WARREN WEBSTER & CO., Camden, N. J.
Representatives in principal U. S. Cities : : Est. 1888
In Canada, Darling Brothers, Limited, Montreal

Webster
HEATING SYSTEMS

Webster Steam and Hot Water Heating Equipment for Industrial Plants

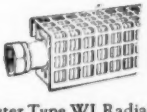


Webster-Nesbitt Propeller Fan Unit Heaters for small and medium-size enclosures having low ceilings.

Webster Series 45 Unit Heater Control combines thermostat, starter with thermal overload cut-out, summer-winter switch, pilot light and thermometer.

Webster-Nesbitt Giant Blower-Fan Heaters for the economical heating of large areas.

Webster Float and Thermostatic Drip Traps for coils and drip points.



Webster Type WI Radiation for installation where floor or wall space is limited.

WATER-TREATMENT QUESTION BOX

WHY pH CONTROL IS IMPORTANT

By Dr R C ULMER, E F Drew & Co Inc

►THIS QUESTION, the sixteenth in a series on water conditioning, comes from the files of Dr R C Ulmer.

Goodwater Laboratory
Drum City, U.S.A.
Dear Chemist:

What is the significance of pH in relation to the alkalinity and the acidity of water?

Yours truly,
Walter Tender

Dear Walter:

Even in the early days of the chemical industry, degree of acidity and alkalinity was of great importance, and attempts were made to control it. Titration methods and tests papers were commonly used that enabled the worker to classify acids and alkalis as strong, moderately strong, moderately weak, etc. Such descriptive terms are vague and instructions to make a solution strongly or weakly acid or alkaline could have no definite meaning.

Introduction of pH measurement showed how rough and inaccurate previous methods had been. It places control of acidity and alkalinity on a definite, scientific basis and enables one to express acidity and alkalinity in numerical values that can be recorded and duplicated at any time by the same or different workers.

Exactly defined, pH is the logarithm of the reciprocal of the hydrogen ion concentration. A simpler explanation is that the pH value is a number between 0 and 14, which denotes the degree of acidity or alkalinity, as in the table, right. The pH scale resembles a thermometer or hydrometer scale. The analogy holds still further, that is, just as a thermometer measures intensity of heat and a hydrometer density (strength) of a solution, so the pH scale indicates intensity of acidity or alkalinity.

To better understand the significance of pH as applied to boiler-water and corrosion problems, here is a little explanation of the chemistry of water. Pure water contains not only molecules of H_2O, but also separated parts of water molecules. The separated parts are called hydrogen ions, written H^+, and hydroxyl ions, written OH^-. The breakdown or dissociation of water is expressed as:

$$H_2O \rightleftarrows H^+ + OH^-.$$

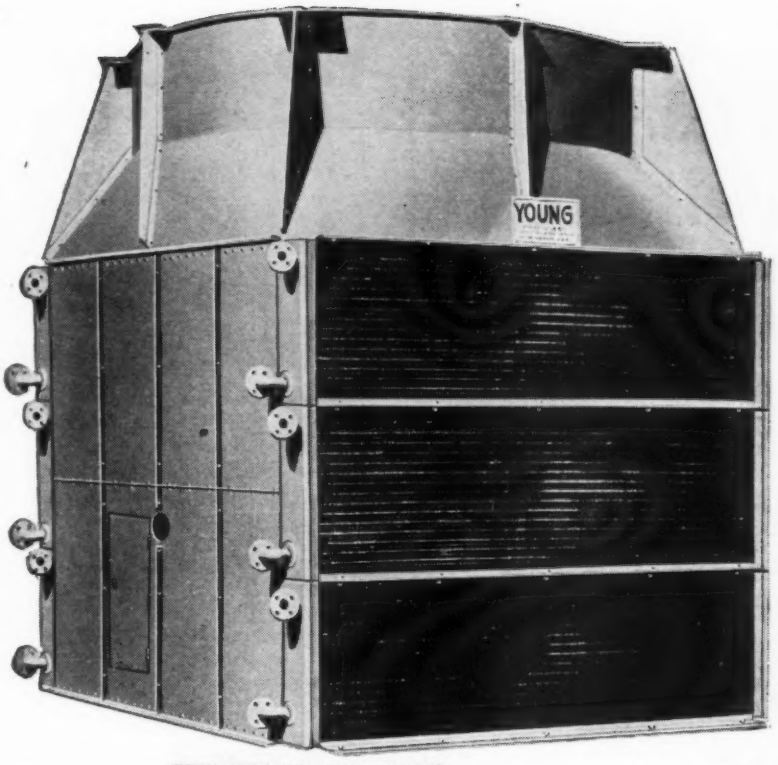
At any temperature the amount of dissociation is constant. At room temperature, 25 C, it is such that the product of the concentration of hydrogen ions, written (H^+) and the concentration of hydroxyl ions, written (OH^-) is $1x10^{-14}$. When the hydrogen ion concentration changes, the hydroxyl ion concentration changes in proportion and always in the opposite direction. That is, if the hydrogen ions increase the hydroxyl ions decrease a corresponding amount, and always so that at equilibrium the product of the two at 25 C is $1x10^{-14}$.

Control of pH is important in water treatment from the standpoint of both scale and corrosion. To prevent corrosion in boilers, a minimum pH of 10.5 is required. In this range, as shown in the table, hydroxides and carbonates are present, which in addition to helping prevent corrosion also help prevent scale. At lower temperatures, for example under atmospheric conditions, a pH of 10.5 is not necessary although usually not objectionable. Slight corrosion, if any, takes place above a pH of 7.0 at atmospheric temperature unless accelerating factors, such as high chlorides, dissolved oxygen, etc, are present. Below a pH of 7.0, corrosion of ferrous metals occurs and corrosion-resistant alloys must be used or corrective treatment employed.

Yours truly,
Chemist
Goodwater Laboratory

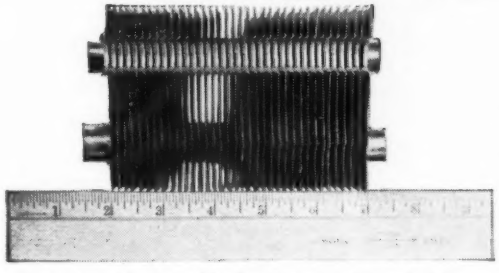
Characteristics of Water at Different pH Values

pH value	General condition	Material present	Values showing intensity of acidity and alkalinity
0			10,000,000
1		Free mineral acid	1,000,000
2		Free carbon dioxide	100,000
3			10,000
4	Acidity		1,000
5			100
6		Bicarbonate	10
7	Neutral	Free carbon dioxide	1
8			10
9		Carbonate bicarbonate	100
10			1,000
11	Alkalinity		10,000
12		Hydroxide carbonate	100,000
13		(possible trace of bicarbonate)	1,000,000
14			10,000,000



YOUNG VERTICAL AIR DISCHARGE COOLING UNIT

Illustrating one model in a new series of large capacity cooling and condensing radiators. Induced-draft fan is mounted horizontally in the shroud with air discharged upward. Rated capacities of the various sizes in the VAD series, when cooling from 150°F. to 140°F. with 100° air, range from 3,300,000 Btu/hr. using 25 H.P. for cooling fan to 9,000,000 Btu/hr. with 50 H.P. fan. Total air swept cooling surface of the largest unit is approximately 42,000 sq. ft.



Section of core used in the above cooling unit. Continuous-type fins are formed from copper strip.

12,800 FEET OF SEAMLESS COPPER TUBE

FOR EFFICIENT COOLING OF WATER, OIL OR GAS

NEARLY 2½ miles of Anaconda Seamless Copper Tube go into the giant Vertical Air Discharge Cooling Unit manufactured by Young Radiator Company, Racine, Wisconsin. Tubes are ⅝″ O.D. x .035″ wall thickness.

The uniformly high quality of Anaconda Deoxidized Copper Tubes is an important factor in the construction of very large heat exchange equipment. For units like this, down to small space heaters and automobile radiators, manufacturers select copper for its high thermal conductivity, corrosion resistance, durability and ease of working. Where unusual corrosion resistance or extra strength is required, The American Brass Company offers a wide choice of the highest quality corrosion-resistant metals in the form of sheets, rods and tubes for heat exchange equipment.

Call on our Technical Department for assistance in selecting the most suitable alloys for your requirements. 6779

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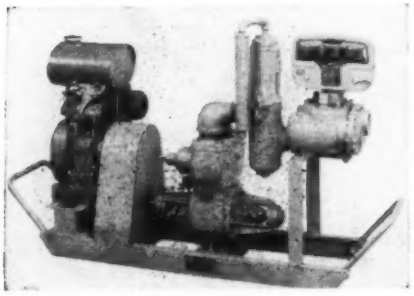
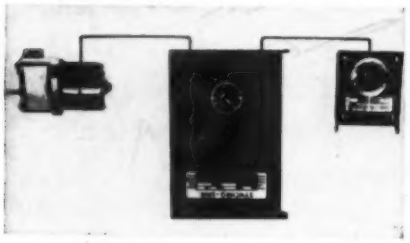
WHAT'S New IN PLANT EQUIPMENT



Fuel-Transfer Pump E76

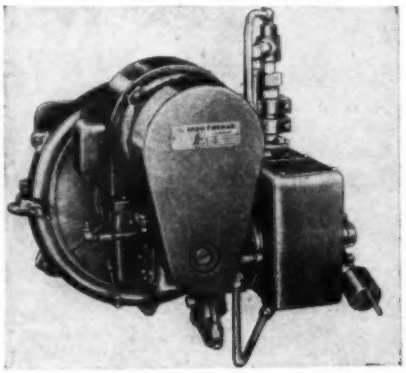
PORTABLE FUEL-TRANSFER 100-gpm pumping unit includes lightweight engine, rotary pump, air eliminator and metering device mounted on rack. Designed for fueling and defueling tank trucks and for fueling tractors, aircraft, buses, etc, at airport, railroad or dock. Pump driven by 6-hp single-cylinder air-cooled 4-cycle gasoline engine through automatic centrifugal clutch. Positive-displacement, self-priming and capable of lifting water more than 25 ft or gasoline to boiling point. Each revolution of rotor gives definite rated output producing continuous liquid flow. Built-in, reversible, adjustable and chatterless relief valve with pressure setting range from 30 to 50 psi. Combination air eliminator and strainer mounted between pump and meter. Air discharge is piped to drippage receptacle equipped with petcock drain. **Harman Equipment Co, Los Angeles, Calif.**



Servo Control E77

THE SYNCHRO-LINK TYPE *SL* 3 is an inexpensive, packaged remote-positioning servo control that quickly and accurately positions one or several distant motors, according to the setting of a master control dial. Accuracy of the setting is independent of the load. Two adjustments are provided: (1) A 3-position switch provides three steps of accuracy consisting of one-half of 1%, 1% and 1¼%; (2) a 4-position switch for extending range and preventing hunting in the event of heavy inertia load in the drive is provided. These adjustments are set once for each application and do not have to be changed afterward.

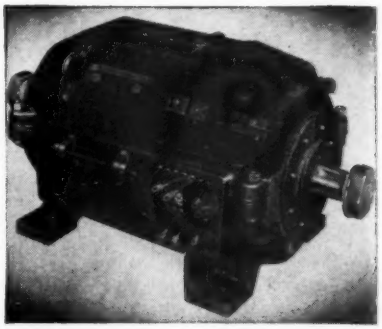
It controls the speed adjustment on variable-speed transmission, the setting of motorized valves, volume dampers, engine throttles, pumps, machine tools, special machinery, etc. The controller contacts handle up to 15 amp, 110 v, ac, noninductive, and up to 10 amp, 220 v, ac, noninductive loads. Any suitable 3-phase reversible motor within the above-mentioned ratings can be connected directly to the *Synchro-Link* controller. Three-phase motors up to 35 hp and more can be controlled by connecting the *Synchro-Link* SL 3 to standard magnetic reversing starters. **The Yardeny Laboratories, Inc, 105 Chambers St, New York, New York.**



Oil Burner E78

ROTARY-CUP OIL BURNER features a positive displacement, variable-volume multicylinder piston-operated pump. Manufacturer states that a steady volume of fuel results regardless of oil temperature and viscosity. Rate of fuel feed is varied by a change in length of piston stroke. Shape of flame may be adjusted by vanes controlling the primary air stream.

Type *R* models range from 8 to 125 gal per hour in capacity with V-belt drive and standard 1750 rpm, NEMA specification electric motors. Controls may be manual, semi-automatic or fully automatic. **Iron Fireman Mfg Co, Portland, Ore.**

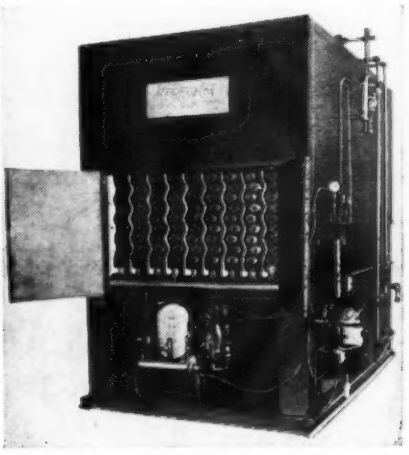


Mill Motor E79

A LARGER AND MORE EFFICIENT armature that fits within limiting dimensions, as well as new roller bearings and redesigned field coils, makes it possible to reduce the size of this motor by one frame size. This heavy-duty type *MC* mill motor is available in totally inclosed, protected self-ventilated or protected force-ventilated construction. It is built in accordance with AISE standardized dimensions and incorporates the following features:

It has a split frame of cast steel; silicone-insulated armature conductor; wedges of Class *B* material to hold coils in slots. A new roller bearing and bearing housings eliminate the need of thrust washer and collar; it also has improved field coil insulation; and rigid mounting of brushholders.

The type *MC* motor is available in sizes from 5 to 200 hp; in voltages of 230 and 550; and in AISE dimension frames 602 to 618. **Westinghouse Electric Corp, Box 2025, Buffalo 5, N. Y.**



Watertube Boiler E80

GAS-FIRED MULTIPLE-JET-BURNER-TYPE 7500-lb-per-hr watertube boiler offers, its manufacturer claims, big boiler design coupled with performance in the small boiler field. Model features inclined watertubes, sectional headers and a longitudinal drum construction.

Manufacturer's full line of boilers, from

To secure additional information on these new equipment items, use convenient reply cards on page 190A. Please be sure to identify your request with the new equipment key letter and number, as shown on the items above.

For complete piping needs see the complete CRANE line

Process piping . . . power plant . . . heating system. Whatever your needs in piping equipment, you can fill them from the complete Crane line. One order covers everything—valves, fittings, pipe, accessories, including shop-fabricated piping assemblies. One order gives you dependable quality in every single item.

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OUTSTANDING QUALITY in every item assures uniformly dependable performance from every part of piping systems.

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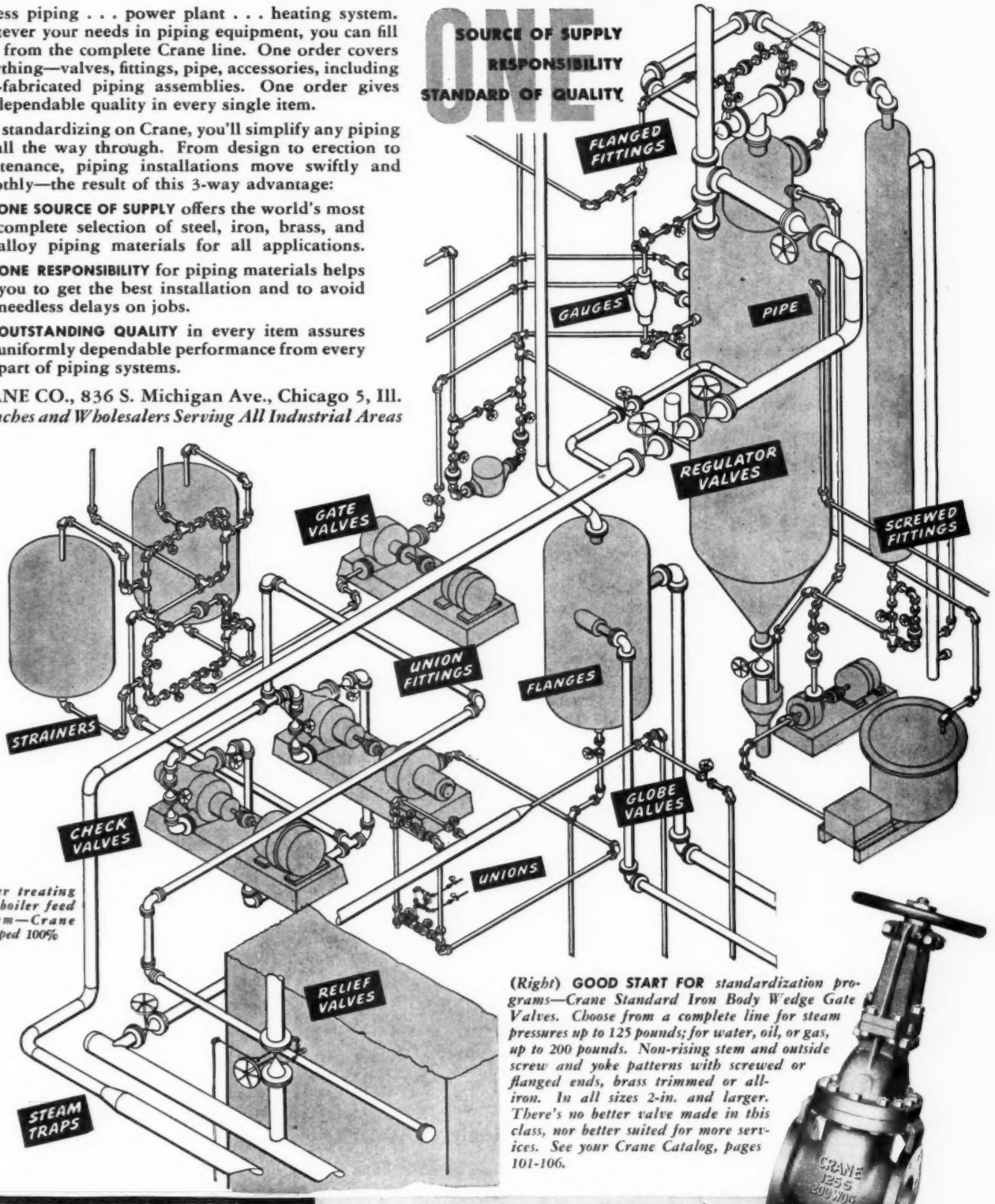

Water treating and boiler feed system—Crane equipped 100%

(*Right*) **GOOD START FOR** *standardization programs—Crane Standard Iron Body Wedge Gate Valves. Choose from a complete line for steam pressures up to 125 pounds; for water, oil, or gas, up to 200 pounds. Non-rising stem and outside screw and yoke patterns with screwed or flanged ends, brass trimmed or all-iron. In all sizes 2-in. and larger. There's no better valve made in this class, nor better suited for more services. See your Crane Catalog, pages 101-106.*

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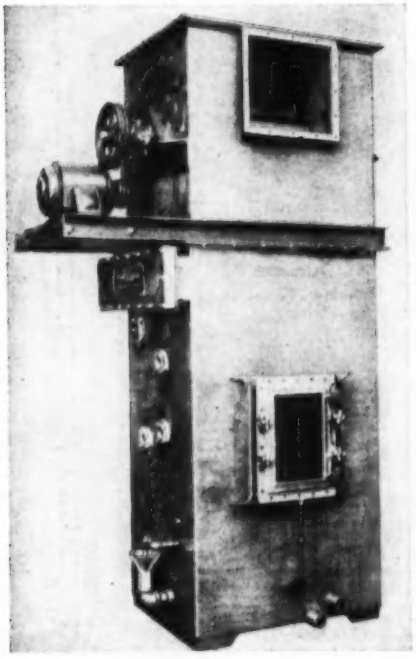
VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

3000 to 7500 lb-per-hr capacity, now offers a choice of burner arrangements allowing use of oil, gas, coal, or any combination of these fuels. **Steamaster Boiler Co, 5819 South Compton Ave, Los Angeles, Calif.**

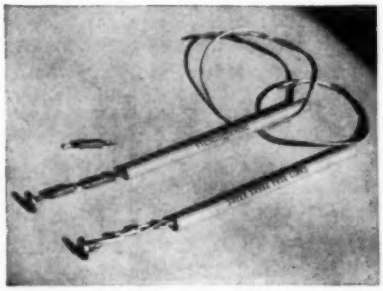


Air Conditioner E81

NEW SATURATING SPRAY Type *A* machine operates on the principle of saturating air with moisture at a given desired dewpoint temperature. Then, by reheating, it produces the exact conditions of relative humidity and temperature needed. Entire apparatus occupies 7½ sq ft and delivers 2000 cfm. Other models, requiring up to 50 sq ft, give air delivery up to 20,000 cfm. Control provides for holding or varying relative humidity at temperatures between 40 and 120 F dewpoint temperature with extremely close tolerance. Lower temperatures can be obtained by using *No Frost* liquid in the spray solution. **Niagara Blower Co, 405 Lexington Ave, New York 17, N. Y.**

Clevis Hook E82

FOR QUICK ATTACHMENT with safety, clevis hook uses a bolt, slotted nut and cotter pin for fastening to ropes, chains or other lifting devices. Hook is easy to attach or change from one job to another, yet meets safety requirement. No welding, machining or threading necessary to attach the hook. Can be supplied with safety latch or with reverse jaw. Made in 1.5-, 2-, 3- and 5-ton sizes with all parts of drop-forged, heat-treated steel. **Thomas Laughlin Co, Portland 6, Me.**



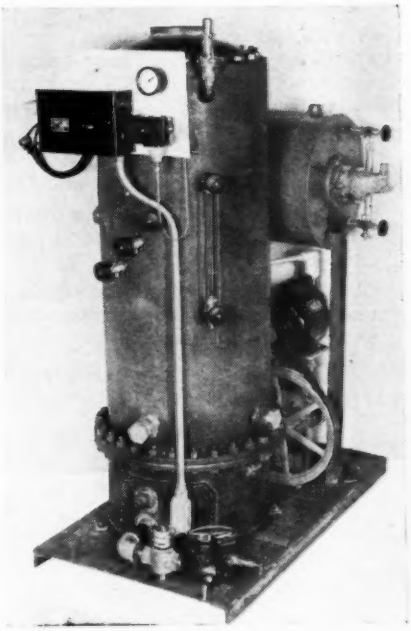
Surge Fuse Link E83

LIGHTNING SURGES and temporary heavy loads within the permissible range of transformer thermal capacities can be carried safely by this new primary distribution fuse. Designed especially for transformer fusing, a new link is of universal type for any indicating or non-indicating NEMA standard distribution porcelain cutout box up to 15-kv rating.

The *Super Surge* fuse link will blow on sustained overloads like any "N" rated fuse, but will continue to carry the current during short-time heavy loads within the thermal capacity of the transformer. They will also carry lightning surges within the transformer surge level that would operate the conventional fuse under 15-amp size. The time-current curve of the new link is identical with the American Standards Association safe-loading curve for small distribution transformers. This makes available most of the thermal overload characteristics of the modern transformer, while a better protective ratio for transformer fusing can be obtained. Fuses are available in 1- 2- 5- 7- and 10-amp sizes. **Westinghouse Electric Corp, Box 868, Pittsburgh, 30, Pa.**

Boiler-Water Analyzer E84

ANALYZER FOR BOILER-WATER test utilizes a photoelectric cell to evaluate the color or cloudiness of test sample. Determines phosphate concentration by depth of color and sulphate concentration by measuring the degree of light transmitted by turbidity, which is produced by adding suitable reagents. Results are read directly on a specially calibrated meter. Reads phosphates up to 100 ppm and sulphates up to 4000 ppm without dilution. **Barclay Chemical Co, 20 Albany St, Cambridge, Mass.**



Packaged Boiler E85

GAS- OR OIL-FIRED, vertical, firetube boiler delivers from 100 to 1500 lb of steam per hr at pressures up to 125 psi, states its manufacturer. Boiler unit comes completely assembled, with all controls, burner, motor, pump, receiver, interconnecting piping and wiring. Unit is intended for 110-v single-phase 60-cycle power. A 750-lb-per-hr boiler occupies 30x48 in. floor space, stands 55¼ in. high, and has a shipping weight of 1700 lb. **Alert Engineering Products, 315 W Woodbridge St, Detroit 26, Mich.**

Skin Protection E86

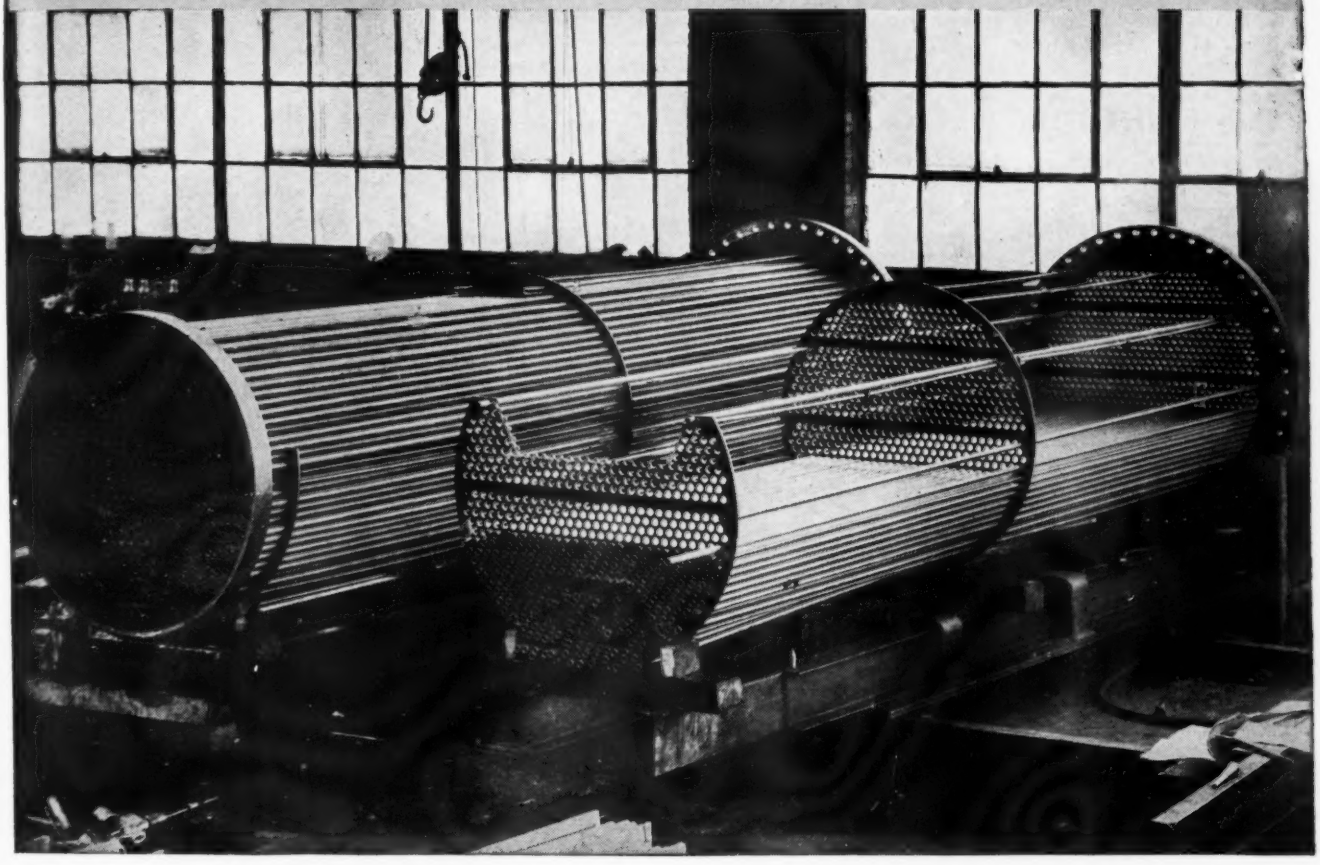
CELLOPHANE-LIKE FILM of emulsified fats and oils protects the hands of the industrial worker from dermatitis, its manufacturer claims. *Hand-Saver* rubbed into the hand permits work with non-aqueous skin-irritants and gives, it is further stated, glove-protection without the restriction. **Cadet Laboratories, Inc, Worcester 5, Mass.**

Window Sash E87

BONDERIZED, STEEL SASH finished with a baked-on rust inhibiting coat gives a weathertight fitting of great strength, its

To secure additional information on these new equipment items, use convenient reply cards on page 190A. Please be sure to identify your request with the new equipment key letter and number, as shown on the items above.

IT'S IMPORTANT TO KNOW ALL THE FACTORS AFFECTING CONDENSER TUBES



In selecting condenser tubes it is often the case that such conditions as temperatures, pressures, and compositions of the gases and fluids will be taken into account fully, only to have the tubes thus chosen give short service. In such cases, it is wise to call in Revere and ask for a thorough check of the situation before assuming that the wrong alloy was specified.

Here is a case in point. Admiralty tubes in a high stage condenser in a refinery were lasting only three or four months. In the effort to increase life, the sour gas had been treated, but as no improvement was experienced, the treatment was discontinued. The Revere Research report, made after laboratory investigation, stated that Admiralty metal was the correct alloy and its use should be continued, but that microscopic study of a failed tube showed definite and conclusive evidence of fatigue corrosion, probably due to vibration. A conference with the people at the plant revealed that the condenser vibrated considerably. Hence the obvious recommendations: cut down the vibration by better bracing, resume treatment of the gas, and continue to use Admiralty tubes. These recommendations were followed, and when last checked the new Admiralty tubes had been serving for eight months and were still going.

The Revere Technical Advisory Service is eager to serve all users of condenser tubes and plates through close collaboration in the study of difficult problems.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

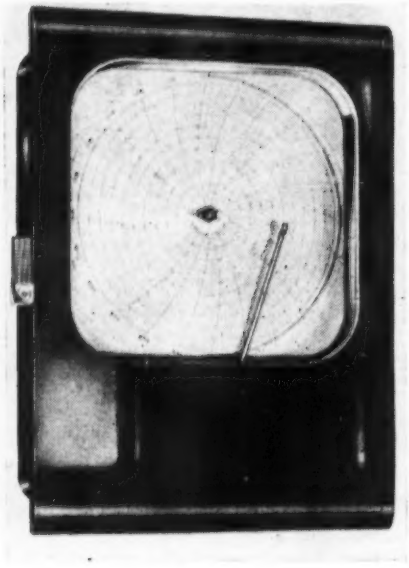
Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

manufacturer claims. Vertical sash bars are bulb T sections and in the *Lok-d Bar* joint the flat T horizontal muntin is threaded through the bulb T.

Ventilators are complete casement-and-frame units welded at the corners with sections rolled into one piece. Air infiltration is said to be less than 1 cfm against a 25-mph wind. **Hape's Windows Inc, Hopkins Ave, Jamestown, N. Y.**

Chain-Grate Stokers E88

COMPLETELY ASSEMBLED factory-tested chain-grate stokers in sizes capable of firing 2000 to 100,000-lb-per-hr boilers can be shipped by rail or trailer truck, claims the manufacturer. The maker further states that the fully packaged unit removes assembly problems in the field and materially reduces erection costs. **McClave Co, 751 Mill St, Allentown, Pa.**

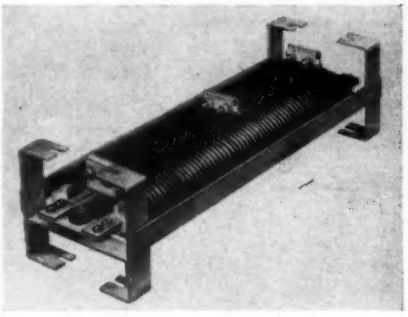


Recording Thermometer E89

NEW LINE OF RECORDING THERMOMETERS and gages known as Series 500 come housed in a newly developed modern case with many improvements that make them easier to use, more convenient to service, and readily convertible from one type to another. The mechanism operates on the same basic principles as in recording thermometers and gages built by the company for many years.

Case is designed so it can be mounted either on a wall, front of panel, or flush on a panel, and can be easily converted from one type of mounting to another. Other features include a heavy inlaid sponge-rubber door gasket, flush roll-type door handle and nonprojecting door hinges. Mounting block, which holds the external connections, is removable. It can be mounted either on the bottom or back of the case.

Pen arms are pivoted on stainless-steel journals with the pen-arm shaft supported at both ends in a rigid one-piece mounting. Journals are ground and polished for low friction. Link members are readily removable without tools and may be equipped with over-range and under-range 2-way springs when required. Improvements have been made in the measuring element to increase its accuracy and the ease with which it can be adjusted. **Bristol Co, Waterbury 91, Conn.**



Edge-Wound Resistor E90

DESIGNED FOR STARTING, dynamic braking, field discharge and plugging, this *Edgeohm* high-current resistor is suitable for dc- or ac-motor controllers and other intermittent-duty high-current applications. It is also suitable for continuous-duty uses in load banks, battery chargers, and welding and plating rheostats.

Sturdy and compact of construction, the *Edgeohm* resistor units are rated 2200 watts continuous duty. They are available with resistances ranging from 0.32 to 4.35 ohms with continuous current-carrying capacities from 21 to 79 amp. A single *Edgeohm* resistor with a duty cycle of 5 sec on, out of each 80 sec, is rated 17,000 watts, based on a 375 C temperature rise. **Ward-Leonard Electric Co, Mt. Vernon, N. Y.**

Thermostat Control E91

THERMOSTAT PROVIDES safe, accurate, fast-acting and constant heat control under the most severe operating conditions. It maintains peak efficiency even though apparatus in which it is installed may be continuously exposed to shock, vibration, tampering and other outside influences. The unit is especially designed for high- and low-temperature ranges. High-temperature model provides control over the wide range of 175 to 600 F. Low-temperature model provides extremely critical control for low-temperature applications through its range of 50 to 250 F.

The one-piece welded case and cover assure a rugged, tamperproof unit. Torque applied to terminal binding post does not shift contact support members. Temperature-adjusting screw will not drift under normal vibration. Mounting bracket provides for side or bottom mounting. A cross-mounting bracket is available for special applications. **Fenwal, Inc, 31 Pleasant St, Ashland, Mass.**

Micrometer Gage E92

ADJUSTABLE FORGED-STEEL arms, moved with a direct-reading micrometer screw, allow measurement of main bearing journals without removing crankshaft from the motor.

Two arms with ground and lapped tips as contact surfaces measure from 2 to 3 in. with an accuracy of .001 in. The *Tumico* micrometer is opened to fit the arms over the main journal after bearing caps are removed; the micrometer spindle is then adjusted to bring the tips into contact position. Direct reading can be made from graduations and numerals recessed in a window opening on the micrometer frame. **Tubular Micrometer Co, St. James, Minn.**

Safety Tile E93

ABRASIVE AND INERT filler materials give a homogeneous, compact structure, claims the manufacturer. A heat-resisting thermosetting phenolic resin to bond the material together, and aluminum oxide as abrasive to make the surface long-wearing and slipproof are additional claims for this 2½-lb-per-sq-ft, moisture-, fire- and oil-resistant tile. **American Abrasive Metals Co, Irvington, N. J.**

Power Pumps E94

FOR LARGER POWER RANGES up to 2400 hp septulex and nonuplex reciprocating pumps use standard quintuplex parts to construct assemblies of 7 and 9 elements. Method of lubrication permits these pumps to operate at speeds so that they can be directly driven by synchronous motors

(*Continued on page* 144)

To secure additional information on these new equipment items, use convenient reply cards on page 190A. Please be sure to identify your resquest with the new equipment key letter and number, as shown on the items above.

A NEW NALCO SERVICE

for utilities and industrial plants

what the NALCO service agreement gives you:

- A complete plant water treatment survey; followed by a detailed report and recommendations on the best means of solving your specific water treatment problems.
- Supervision of water treatment control and testing practices to assure continued water treatment efficiency; and to minimize the possibility of shutdowns due to water treatment troubles.
- Regular Nalco Service calls to check results; and routine water analysis reports from the Nalco Laboratories to detect and correct changes in raw water characteristics.

UTILITIES and plants where the need for water treatment chemicals is small—due to low make-up, good raw water characteristics, or low water volume requirements—can now secure the full benefits of Nalco Water Treatment Service, regardless of chemical purchases.

This new Nalco Service is the answer to a growing demand for expert water treatment analysis and advice on control and testing procedures. Plants operating under a Nalco Service Agreement receive the full use of the complete Nalco facilities, experience and skill in setting up and maintaining a water treatment control system designed for the specific conditions under which each plant operates.

Brief facts on the Nalco Service Agreement are given at left. For further information, write Nalco, or call your Nalco Representative.

NATIONAL ALUMINATE CORPORATION

6222 W. 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario

THE SCIENTIFIC SYSTEM OF WATER TREATMENT FOR ALL INDUSTRY

Nalco

How to plan

BULK STORAGE STATION PUMP HOUSE CONNECTIONS

Another in the series of basic piping layouts prepared by Jenkins Bros.

Bulk stations for the storage of gas, fuel oils, or other liquid fuels are usually laid out with either a single or double line system. In the single line system, all tanks containing one grade of oil are connected to the pump house by a common line. In the double line system illustrated here, each storage tank is connected to the pump house by an individual line. This system is used most often because tanks can be loaded and unloaded at the same time and stocks can be transferred from tank to tank in an emergency.

The pump house connections for the two systems differ only in the number of pump house tie-ins. The double line system has more connections which allow for maximum handling efficiency. In addition to the lines from the storage tanks, the pump suction and discharge headers must be connected to the pipe lines from tankers, tank cars, and truck tanks. With these connections, liquids can be transferred to or from any mobile equipment, as well as storage tanks, by opening only the correct suction and discharge header valves.

The duplicate pump installation provides emergency standby service and also allows for two separate and simultaneous pumping operations. The system shown uses standard pipe fittings and Iron Body Bronze Mounted Valves. An alternate list of Jenkins Cast Steel Valves with either flanged or welding ends is included for those desiring an all steel installation. Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation. Copies of Layout No. 28 will be furnished on request. Mail coupon.

Jenkins PRACTICAL PIPING LAYOUTS 28

Illustrating the proven 3-point formula for trouble-free, time-defying hookups

A Use the right type valve for the service.
B Place valves correctly in the line.
C Choose Jenkins Valves for lifetime economy.

Fig. 651, the Jenkins Iron Body, Bronze Mounted Gate Valve recommended in this layout for suction header, discharge header and pump suction shutdown is especially suitable for use with fuel oils where full, free, unobstructed flow is desired. The solid wedge provides maximum resistance to pressure strains, assuring long life. Operating threads on the bronze spindle are readily accessible for cleaning and lubrication. The bronze seat rings are renewable.

A CHOICE OF OVER 600 JENKINS VALVES

To save time, to simplify planning, to get the advantage of Jenkins specialized valve engineering experience . . . select all valves from the Jenkins Catalog. It's your best assurance of the *lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK
SINCE 1864

TRADE JENKINS MARK

125 TO 600 LBS. STEAM PRESSURE

Jenkins Bros

BULK STORAGE STATION PUMP HOUSE CONNECTIONS

TO TRUCK TANKS OR FROM TRUCK TANKS
PUMP # 1 DISCHARGE HEADER
PUMP # 2 DISCHARGE HEADER
TO RAILROAD TANK CARS OR FROM TANK CARS
TO FUEL OIL STORAGE TANKS OR FROM STORAGE TANKS
PUMP # 1 SUCTION HEADER
PUMP # 2 SUCTION HEADER
TO SHIP STORAGE TANKS OR FROM FUEL OIL TANKER BOATS
PUMP # 1
PUMP # 2
A
B
C
D
E

VALVE RECOMMENDATIONS

For details and valves to suit varying conditions see Jenkins Catalog.

Code	Quan.	Iron Body Valves	Alternate Cast Steel Valves*	Service
A	12	Fig. 651 O.S.&Y. Gate	Fig. 1009	Suction Header Selection
B	12	Fig. 651 O.S.&Y. Gate	Fig. 1009	Discharge Header Selection
C	2	Fig. 651 O.S.&Y. Gate	Fig. 1009	Pump Suction Shutdown
D	2	Fig. 613 O.S.&Y. Globe	Fig. 1040	Pump Discharge Control
E	2	Fig. 624 Swing Check	Fig. 1025	Pump Discharge Check

*These valves also furnished with welding ends.

Diagram by Huxley Madeheim, Consulting Engineer

BRONZE • IRON • STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE
SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

JENKINS BROS., 80 White St., New York 13, N. Y.

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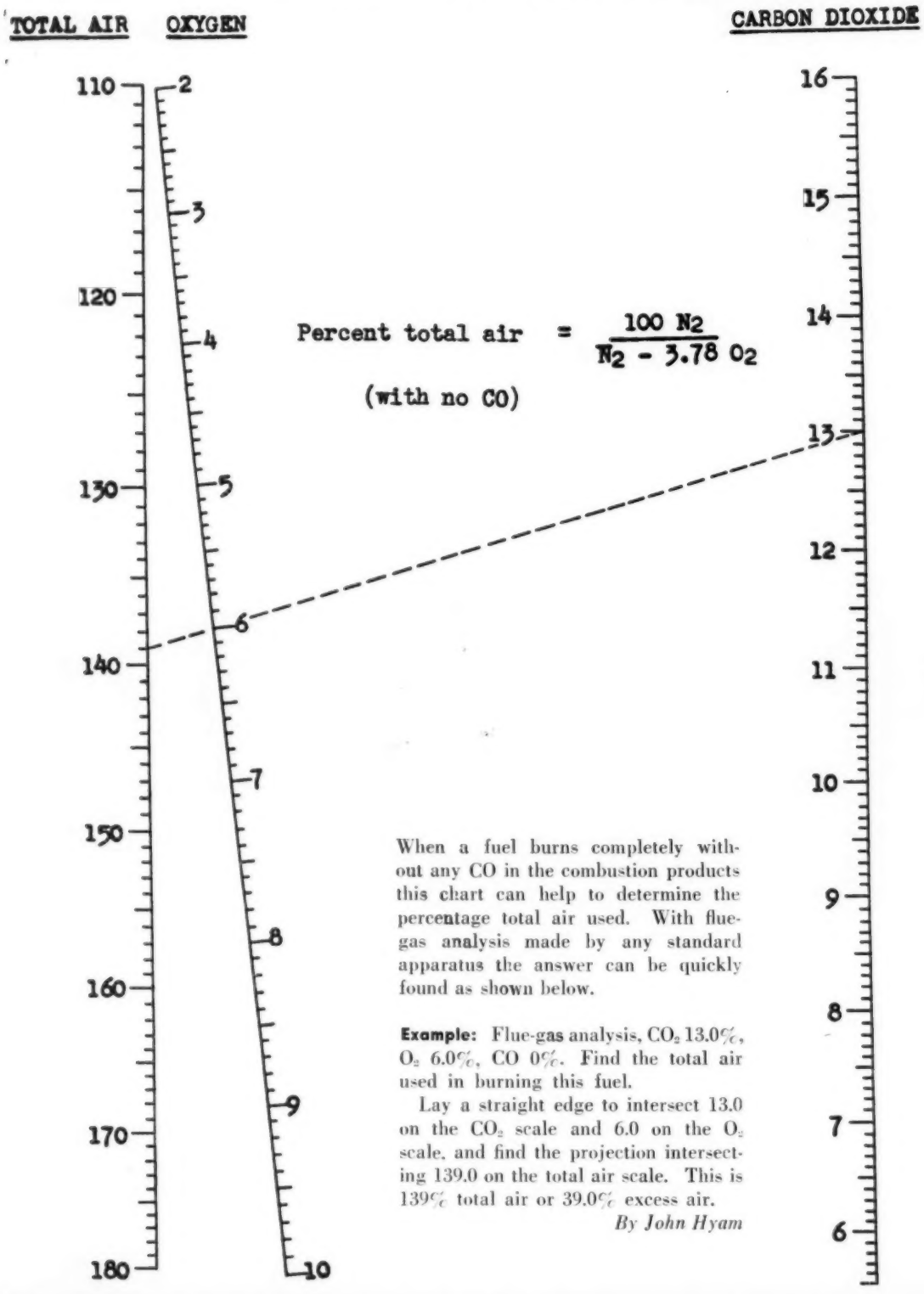
Number 183

TOTAL AIR FOR COMBUSTION



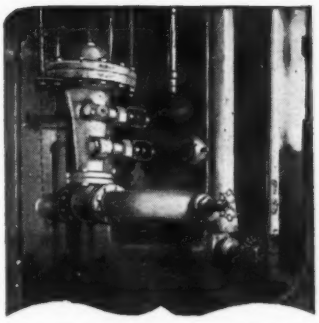
When a fuel burns completely without any CO in the combustion products this chart can help to determine the percentage total air used. With flue-gas analysis made by any standard apparatus the answer can be quickly found as shown below.

Example: Flue-gas analysis, CO_2 13.0%, O_2 6.0%, CO 0%. Find the total air used in burning this fuel.

Lay a straight edge to intersect 13.0 on the CO_2 scale and 6.0 on the O_2 scale, and find the projection intersecting 139.0 on the total air scale. This is 139% total air or 39.0% excess air.

By John Hyam

© POWER



Canadian steel mill controls level in 150-psi Foster Wheeler boiler with a direct-operated Flowmatic

Over 300 million pounds per hour

Add capacities of the 2000-plus boilers for which COPES Flowmatic Control has been ordered and they total more than 300,000,000 pounds of steam per hour. Individual boiler capacities run from 10,000 to 700,000 pounds per hour; pressures from 80 to 1825 psi.

This wide acceptance of the two-element COPES Flowmatic Boiler Feed Water Control results from the fact that all installations have one thing in common: Boiler water level is stabilized within remarkably close and safe limits, regardless of speed or severity of load fluctuations, while feed water input is geared to steam output for high operating efficiency.

Write us in detail about your operating conditions, and you'll receive helpful data.

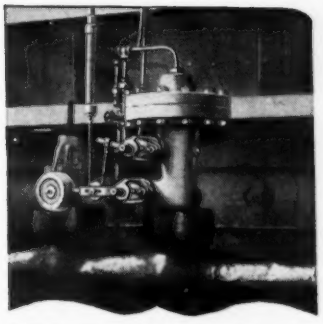
NORTHERN EQUIPMENT COMPANY

1171 GROVE DRIVE, ERIE, PENNSYLVANIA

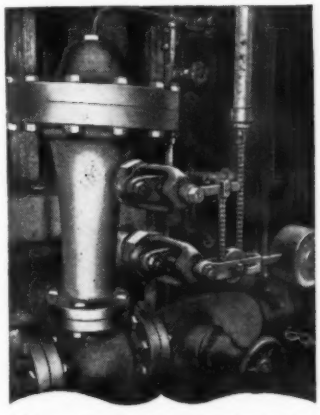
Feed Water Regulators, Pump Governors, Differential Valves, Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS: Canada, England, France, Austria

Representatives Everywhere

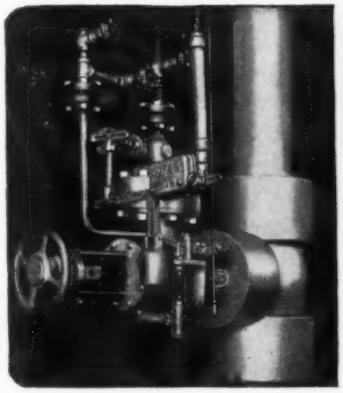


Direct-operated Flowmatic controls level on this 410-psi Riley boiler carrying fluctuating loads

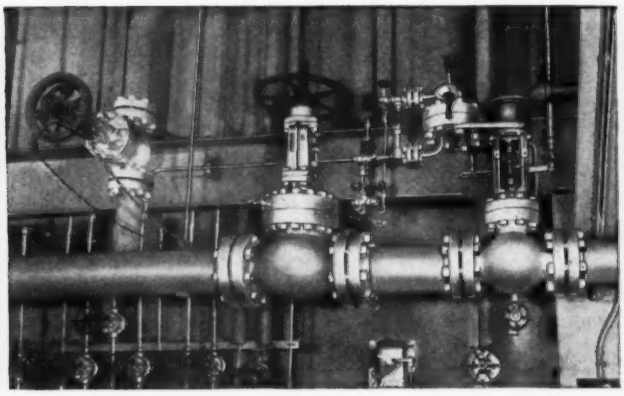


125-psi Union Iron Works boiler in food-processing plant is equipped with direct Flowmatic

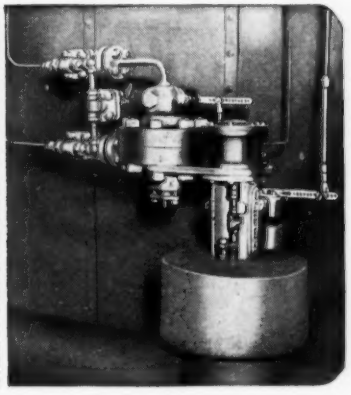
Southern municipal power plant has direct-operated Flowmatic on 420-psi B & W Stirling boiler



Vertical-line installation: Relay operated Flowmatic on 675-psi C-E unit in Eastern utility plant

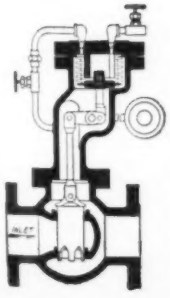


Relay Flowmatic controls level for 675-psi, 220,000 lb-per-hr Foster Wheeler unit in one of three stations of prominent utility system discussed in Bulletin 463



1265 psi, 275,000 lb per hr. Two C-E boilers in utility station are Flowmatic-equipped. Bulletin 465

★ *Get Closer Level Control With The* COPES FLOWMATIC

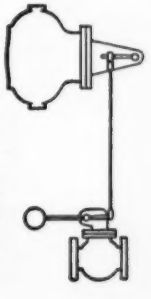


DIFFERENTIAL VALVES

COPES Differential Valves maintain constant pressure drop across the feed water regulator valves, regardless of changes in pump pressure or line friction losses accompanying wide fluctuations in boiler load. Individually designed for each installation. Available in separate bodies, as illustrated, or in combination with the feed water regulator valve bodies.

LIQUID LEVEL CONTROL

For control of water or steam input or output, open or closed vessels. For throttling steam supply to fluid pumps. Semi-steel, cast-steel or forged-steel float chambers, with floats of different sizes and materials to meet individual needs. The direct- or relay-operated COPES Valves have low friction, high lift, accurate balance, ports designed for each installation.



Do You Practice "Buymanship"?

All of us have heard fellow engineers say, "I never see salesmen because they waste my time," or, "I see salesmen only from three to four." This is a defensive, suspicious, hard-boiled attitude that harms nobody but the buyer.

The smart power engineer uses "buymanship" instead—a sensible, intelligent view toward buying. I learned the lesson long ago that the salesmen who come in to see me may have something worth looking into. So I see 'em, and about every fourth or fifth one has an idea I can put to work. That's a pretty good average to me.

My answer to the boys who turn salesmen away because "Our company isn't buying anything now," is to ask them what they would say about a product or an idea that would pay for itself in six months. Of course they would want to look into it—and a good many salesmen carry around just such ideas.

Salesmanship has come a long way since the old "high-pressure" days. There was a lot of hocus-pocus connected with a good many of the old peddlers who came around, and you could never be quite sure that you could find them again after they left your office. Today, it's a very different story. The average salesman is a pretty competent engineer, and he is usually armed with a lot of valuable information his home-office staff has spent considerable time and money in producing for him.

So, it's a pretty sound proposition to use *buymanship* on these people. Listen to their stories, turn off the ones who have nothing to contribute, and gather in the good ideas from the many salesmen who can help you. A sensible, inquiring attitude can bring you good dividends.

George Edwards

Engineer

Power

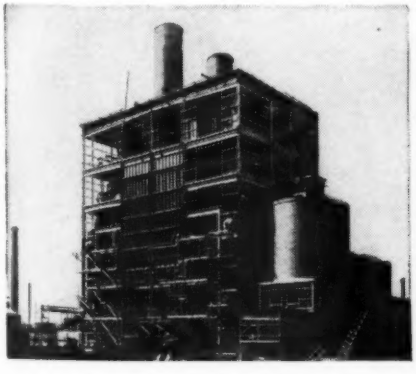
for Petroleum Refining

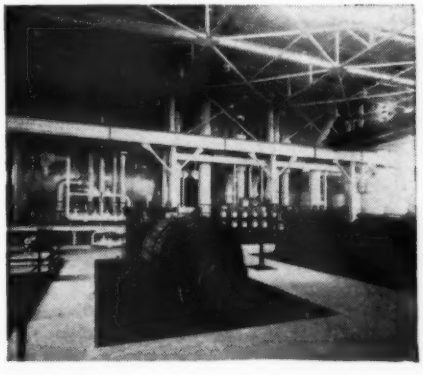
Great refineries of Standard Oil Company of Indiana convert the mid-continent's *black gold* into the myriad products and by-products which power and lubricate the planes, trains, ships, motor cars, production machinery in a large sector of industrial America.

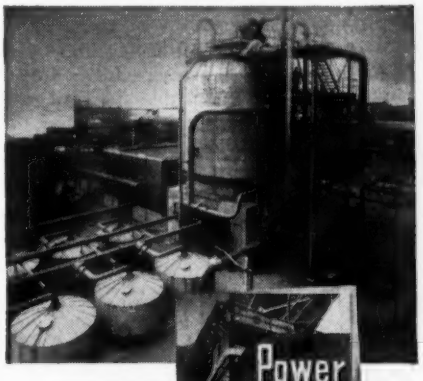
But refineries, too, require power,—electricity, steam, compressed air, liquid pumping. At its huge Wood River, Illinois, refinery Standard Oil Company planned for present and future needs with a modern plant designed to provide all the power services for petroleum processing.

Dravo Corporation Power Plant Specialists accepted complete responsibility for construction of foundations, building, and equipment installation at Wood River; Standard Oil Company Construction Engineers were relieved of details of supervision, building trades coordination, integration of separate items of equipment.

Power and Boiler Plant Specialists at Dravo Corporation have a background of experience which can be of real value to industrial executives and consulting engineers concerned with construction and equipment installations for all types of power and boiler facilities. Further details of this Dravo experience are covered in Bulletin CF-504; Power Department, 300 Penn Avenue, Pittsburgh 22, Pa.







DRAVO CORPORATION

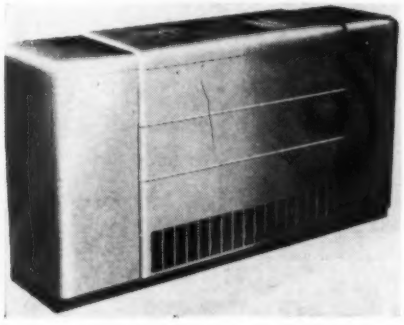
PITTSBURGH — PHILADELPHIA — CLEVELAND
NEW YORK — DETROIT — WASHINGTON
WILMINGTON

Power and Boiler Plants — Pumping Stations — Power Plant and Contractors' Equipment — Direct-Fired Heaters — Industrial Heating and Ventilating — Bridge Substructures — Docks — Pump Houses and Intakes — Mill Foundations — Locks and Dams — Shafts, Slopes and Tunnels — Towboats and Barges — Coal and Ore Bridges — Cranes and Derrick Boats — Crane Cab Coolers — Open Steel Flooring — Concrete Aggregates — Inland River Transportation

Equipment *Continued*

mounted on the pump crankshaft. Largest sizes may be directly coupled to 225- or 275-rpm engines. In 800-hp size and below, pumps have built-in gears whose pinion shaft directly couples to a high-speed motor or engine.

For oil-field service, pumps have ring joint construction on valve covers, discharge and flange connections, also stuffing-box liners for different-sized plungers. **Aldrich Pump Co, Allentown, Pa.**



Unit Ventilator E95

UNIT VENTILATOR for auditoriums and industrial installations incorporates resilient belt-drive mechanism for quieter operation. Unit uses a steam-distributing coil, which prevents freeze-ups in cold weather when heating outside air for ventilation. **Trane Co, La Crosse, Wis.**

Welding Electrode E96

IMPROVED AIRCO NO. 312 ELECTRODE is all-position, mild-steel electrode designed to produce weld metal possessing not only good mechanical properties, but also low hydrogen content. It can now be used on ac and dc reverse polarity and needs no preheating to obtain porosity-free weld deposits.

Manufacturer recommends this device for use in welding high-sulphur free-machining steels, hardenable steels where no preheat is used, cold rolled steel, and where the surfaces are to be vitreous-enameled after welding. **Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.**

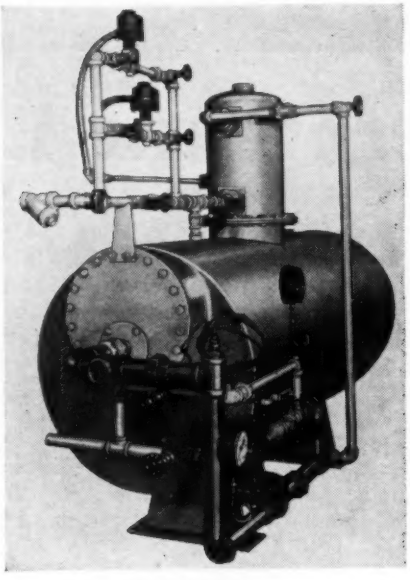
Portable Cleaner E97

PORTABLE, 4-PURPOSE ELECTRIC CLEANER comes in two models: Heavy duty, a 25,000-ft-per-min capacity blower powered by a 1 1/3-hp motor and weighing 14½ lb; medium duty, a 19,000-ft-per-min blower with a 2/3-hp motor, weighing 9½ lb. Both models have sealed ball bearings and air-stream cooling scrolls which, its manufacturer states, permit 24 hr a day operation if needed.

These units can serve as vacuum cleaners, blowers or sprayers. With attachment of a heater nozzle that raises air-flow temperature to 85 F they can also act as driers. **Ideal Industries, Inc, 1025 Park Ave, Sycamore, Ill.**

Metallic Packing E98

IMPROVED FLOATING-SEA metallic packing features simple construction and more efficient performance. It is adaptable to both rod and plunger operation, and is useful for all types of compressors. The packing will hold 1500-psi hydraulic pressure with one unit, made up of two metal rings and a synthetic ring. The old type required three units. **Rodpak Mfg Co, San Francisco, Calif.**



Deaerating Heater E99

THIS HEATER REDUCES oxygen content of boiler feedwater to less than 0.06 cc per liter. Process consists of preheating all feedwater that enters the deaerator receiver and diffusing the water under pressure through a series of spray nozzles into a fine film. Use of alloys and corrosion-resistant materials reduces maintenance to a minimum. Completely automatic equipment includes gages, thermostats and regulators, as well as a vent condenser and spray header. Available in sizes from 3400 to 34,000 lb per hr rating. **Fred H Schaub Engrg Co, 2110 S Marshall Blvd, Chicago 23, Ill.**

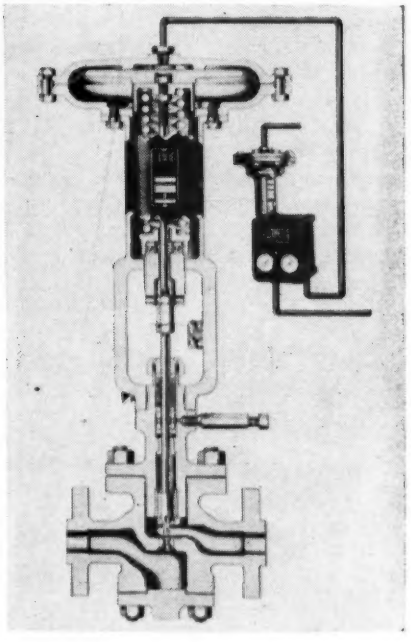
Tube Cutter E100

NEW TYPE AA internal condenser tube cutter is air-driven and operates on 80-to-120-psi air pressure. Weight is 13 lb, length 20 in. and speed 1200 rpm. Cutter is adaptable to ⅝- ¾- ⅞- and 1-in. tubes of various gages, also serrating of tube-sheet holes. An adjustable-depth stop serves for various sheet thicknesses. A trimming stop that can be installed in a few moments serves for trimming uneven tube ends outside of sheet.

Cutter comes complete with one setup for each size tubing of various gages, trimming stop, extra blades, extra pilot, wrenches, and necessary instructions. The serrating adapters and extra long spindle used for extra-thick tube sheets to 6 in. are sold as extras. **Armstrong & Sons, 1061 Linden Ave, Ridgefield, N. J.**

Air Separator E101

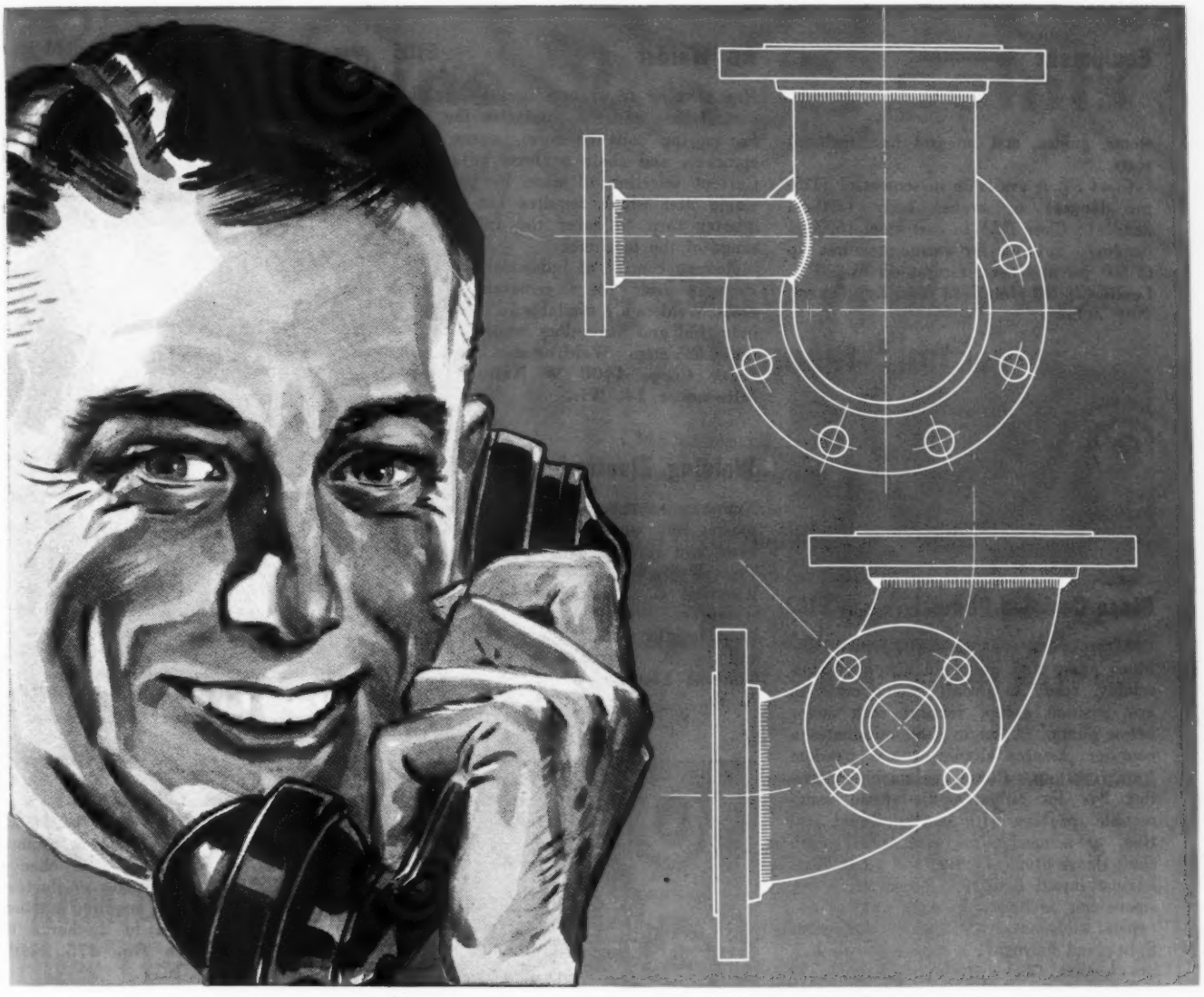
NEW CMD MODEL E SEPARATORS are mechanical in operation, requiring no attention other than draining off condensate that accumulates in the chamber. They have no moving parts—screens, filters, felt or wool. Noncorrosive metals are used throughout. Model *E* has a maximum rated capacity of 250 cfm and is 8 in. in diameter, 15 in. high, having 1½ in. standard pipe connections. **Chicago Mfg & Distributing Co, 1928 W 46th St, Chicago 9, Ill.**



Regulating Valve E102

NEW DESIGN FEATURES in the Class *DL* and *DLS* diaphragm-regulating valves include a *Conden-Seal* cooling bonnet with a stainless-steel radiating tube and condensate reservoir for steam service to protect the packing gland at temperatures above 450 F. Other features are hardened stainless-steel

To secure additional information on these new equipment items, use convenient reply cards on page 190A. Please be sure to identify your request with the new equipment key letter and number, as shown on the items above.



"Right Away is Right!"

THERE was no delay in procuring the special fitting shown above. It was fabricated on the spot, when needed, with a standard TUBE-TURN welding elbow taken from the nearby TUBE-TURN distributor's stock.

Thus, TUBE-TURN welding fittings and the welder's art save time and money on special applications in countless variations.

TUBE-TURN welding fittings are particularly suitable for pipe fabrication because of the uniform wall thickness and full circularity which allows them to be successfully cut and joined in special ways. They are uniform from fitting to fitting. Order two or a thousand TUBE-TURN welding fittings of the same size and part number—they will be dimensionally alike.

The extent of the TUBE-TURN line is a big advantage in solving many different problems of pipe engineering and fabrication. There are more than 4000 different types and sizes of TUBE-TURN welding fittings and flanges. They come in many metals and alloys. For details, contact your nearest TUBE-TURN distributor. For his name, write to—

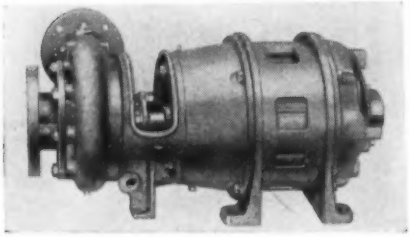
TUBE TURNS, INC., LOUISVILLE 1, KENTUCKY

District Offices at New York, Philadelphia, Pittsburgh, Detroit, Chicago, Houston, Tulsa, San Francisco, Los Angeles

TUBE-TURN tt TRADE MARK *Welding Fittings and Flanges*

stems, guides, and integral hard-surfaced seats.

Class *DL* is available in semi-steel (125-psi flanges) or bronze body (300-psi flanges); Class *DLS* in cast steel (600-psi flanges). Suitable for steam pressures up to 600 psi and temperatures up to 800 F. **Leslie Co, 50 Delafield Ave, Lyndhurst, New Jersey.**



Close-Coupled Pump E103

CLOSE-COUPLED CENTRIFUGAL PUMP combines pump and motor in a compact assembly, ready to install and operate in any position except vertical with motor below pump. A single shaft eliminates a coupling, assures alignment and freedom from vibration. Pump has machined stuffing box for either a die-formed semi-metallic packing with lantern liquid seal ring, or a mechanical seal. Full-length shaft sleeve protects motor and pump shaft against liquid damage. When necessary, sleeve can be removed easily. Sleeve can expand and contract to prevent distortion. Split-gland halves, held together with hollow washers, make it unnecessary to unbolt gland halves when packing a pump. Available in 17 capacities up to 2000 gpm and heads up to 400 ft, depending on pump size. **Goulds Pumps, Inc, Seneca Falls, N. Y.**

Glass Insulation E104

NEW LINE OF LIGHTWEIGHT, high temperature insulating material composed of specially processed filaments of glass, in felt and bulk form, withstands temperatures up to 1800 F. The new material is suitable for insulating housings and flange covers of high-temperature steam turbines, and exhaust manifolds and turbine supercharger housings on oil- or gas-fired diesel engines. It can also be used as a filtering element in flash separators in high-temperature processing equipment. Manufacturer says both forms remain flexible and dimensionally stable at the upper temperature limit, are unaffected by repeated heating and cooling, and by most acids, and are not corrosive to metals with which they come in contact. **Owens-Corning Fiberglas Corp, 718 Fifth Ave, New York 19, N. Y.**

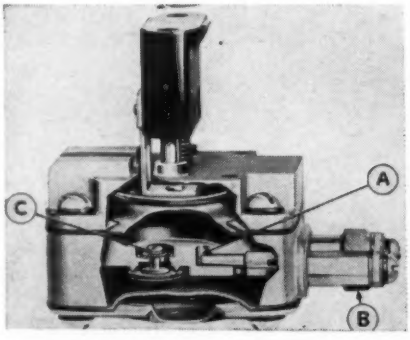
AC Welder E105

NEW LINE OF AC WELDERS uses a simplified control that entirely eliminates the need for moving coils or cores, worm gears, sprockets and chain or lever adjustment. Current selection is made by turning a single dial which requires but a three-quarter turn to cover the full welding range of the machine.

Remote control of industrial models is made possible by a removable control dial. Welders are available in intermittent industrial and heavy-duty models, ranging up to 625 amp. **Welding div, Harnischfeger Corp, 4400 W National Ave, Milwaukee 14, Wis.**

Welding Electrode E106

NEW WELDING ELECTRODE for hard-surfacing applications where resistance to impact, wear, and abrasion is required, known as Type *W*-94, will work-harden to over 60 Rockwell C. It operates on ac or dc reverse polarity. The rod is available in 14-in. lengths with diameters of ¼, $\frac{5}{16}$, $\frac{5}{32}$ and ⅛ in. Standard packages, 50 lb. **General Electric Co, Schenectady 5, N. Y.**



Pneumatic Timers E107

PROVIDING WIDE RANGE of time-limit motor acceleration, these timers are unaffected by normal variations in ambient temperature and voltage conditions. Timing errors are eliminated as the result of friction between surfaces or moving parts, mechanical wear, or foreign material on magnetic surfaces. Air is transferred from lower to upper chamber through metering orifice (*A*). Rotation of knurled wheel (*B*) gives wide range of adjustment. Air returns through valve (*C*) for instantaneous reset. Timers may be coupled directly to contactors or actuated by separate magnets. **Square D Co, Milwaukee, Wis.**

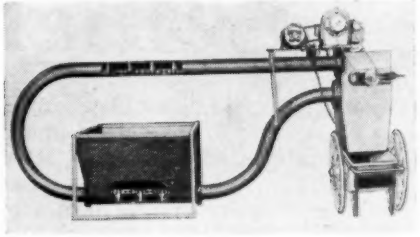
Electric Tester E108

THE SURE-TEST UNIVERSAL TESTER consists of an insulated sprocket around which is wound 6 ft of test wire. The test cord terminates at one end in a standard base plug and at the other in two test prods. The test lamp is conveniently located in one of the test prods and is protected by a filtered circuit to eliminate all false indications caused by adjacent live wires, inductance and capacitance. A high resistance is inclosed in the other test prod to avoid accidental grounds. A specially fitted Neon test circuit gives the equivalent results of a large lamp.

Inserting the attached plug into a base receptacle enables the user to check continuity with the test prod. Power circuits, from 110 to 600 v, are tested by inserting the rubber plug into a self-contained socket on the frame. Test prods are then used in the conventional manner for location of blown fuses, or detection of grounds. **Star Fuse Co, 235 Canal St, New York 13, N. Y.**

Thermostatic Trap E109

NEW CAST-STEEL thermostatic trap with helical bellows withstands shock, handles corrosive condensate, and operates at pressures up to 300 psi, or with superheat. Thermostatic element is of stainless steel for corrosive condensate and superheat, or for a maximum operating pressure of 300 psi. Another series has a bronze thermostatic element for maximum operating pressures to 225-psi saturated steam. Differential between pressure created in the thermostatic bellows and the steam pressure remains practically constant; therefore it is not necessary to change the seats for pressure changes or fluctuations. No protection is required against freezing when installed to discharge to the atmosphere. **Sarco Co, 475 Fifth Ave, New York 17, N. Y.**



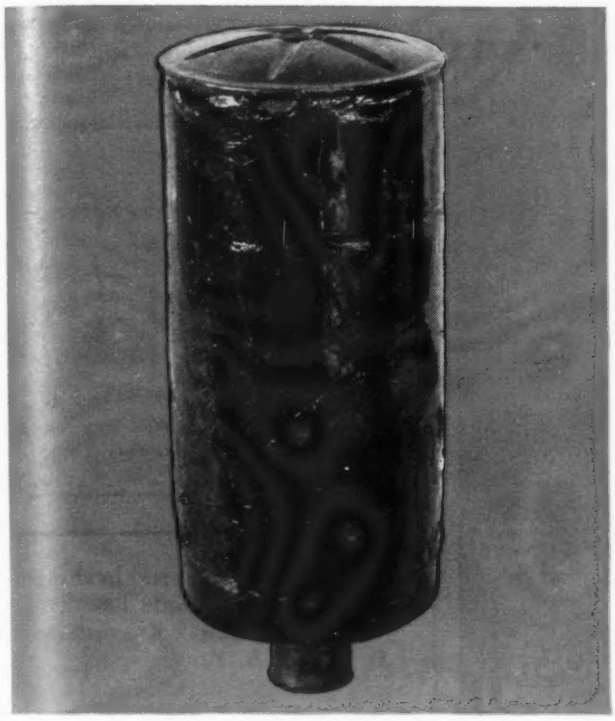
Transfer Conveyor E110

CONVEYOR AUTOMATICALLY REMOVES sediment from settling tanks without removal of fluid. It is basically a motor-driven endless-link chain on which 4-in. Neoprene rubber flights are mounted 6 in. apart. It runs through the V-bottom of a settling tank, trapping the sediment between flights and conveying it through a 4-in. pipe to disposal equipment. After leaving the tank, conveyor turns upward steeply to allow fluid to drain back. Sediment is carried along to dumping point

(*Continued on page* 164)

To secure additional information on these new equipment items, use convenient reply cards on page 190A. Please be sure to identify your request with the new equipment key letter and number, as shown on the items above.

Diesel Engine DANGER points

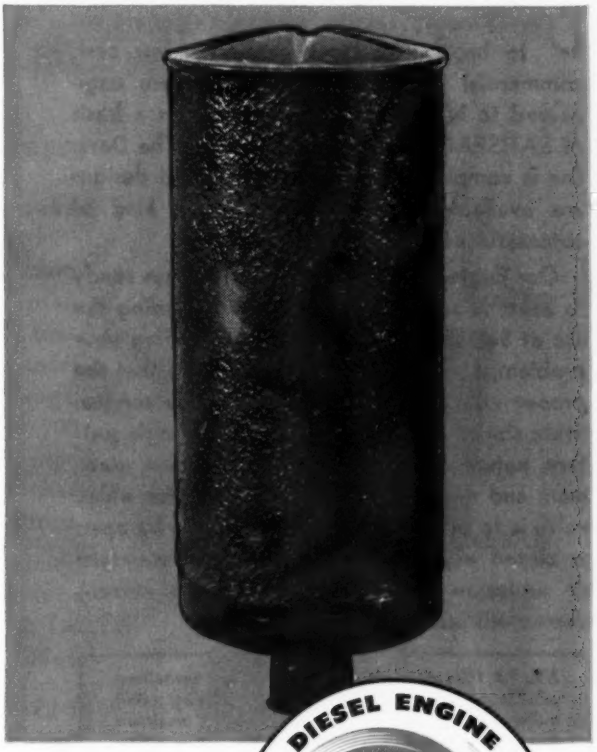


Filter deposits formed in 204 hours with best uncompounded mineral oil.

Clogged Oil Filters Cause Frequent Shutdowns

One cause of frequent costly and time-wasting Diesel shutdowns is filter clogging. The condition can become dangerous since a clogged filter may stop circulation of oil to the engine if the warning of a drop in oil pressure is not heeded. Analysis of filter deposits prove them to be composed of products resulting from incomplete burning of the fuel and oxidation of oil plus iron, silica and water.

Filter Deposit formed in 1230 hours with RPM DELO Oil.



RPM DELO Oil Reduces Filter Clogging Two Ways

As the two filters illustrated show, RPM DELO Diesel Engine Lubricating Oil greatly lengthens the time between shutdowns for filter servicing. This is accomplished in two ways:

1. A detergent in RPM DELO Oil prevents the stuck piston rings which, through blow-by, permit dust, unburned fuel and carbon to mix with oil.

2. Another compound in RPM DELO Oil fortifies it against oxidation.

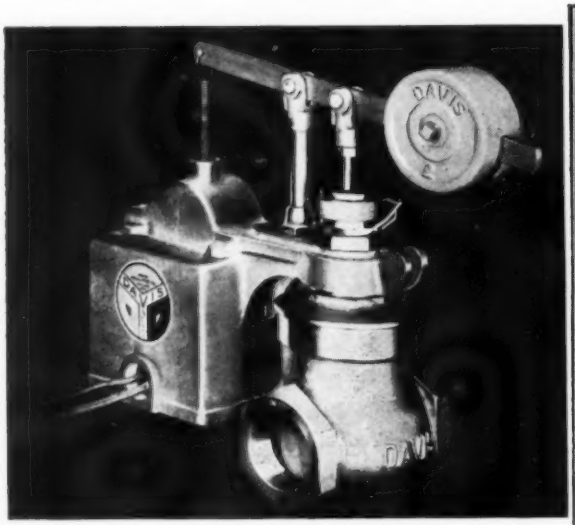
Other additives in RPM DELO Oil protect Diesel Engines against corrosion, excessive wear on upper cylinder walls, and foaming.

DIESEL ENGINE RPM DELO LUBRICATING OIL

To match the fine performance of RPM DELO OIL, use these equally efficient companion products from the same famous "RPM" line – RPM HEAVY DUTY MOTOR OIL – RPM COMPOUNDED MOTOR OIL – RPM GEAR OILS AND LUBRICANTS – RPM GREASES. For additional information or name of your distributor, write any of the companies below:

STANDARD OF CALIFORNIA · 225 Bush St., San Francisco 20, California
THE CALIFORNIA COMPANY · 17th and Stout Streets, Denver 1, Colorado
STANDARD OIL COMPANY OF TEXAS · El Paso, Texas
THE CALIFORNIA OIL COMPANY · 30 Rockefeller Plaza, New York 20

SOLENOID VALVES



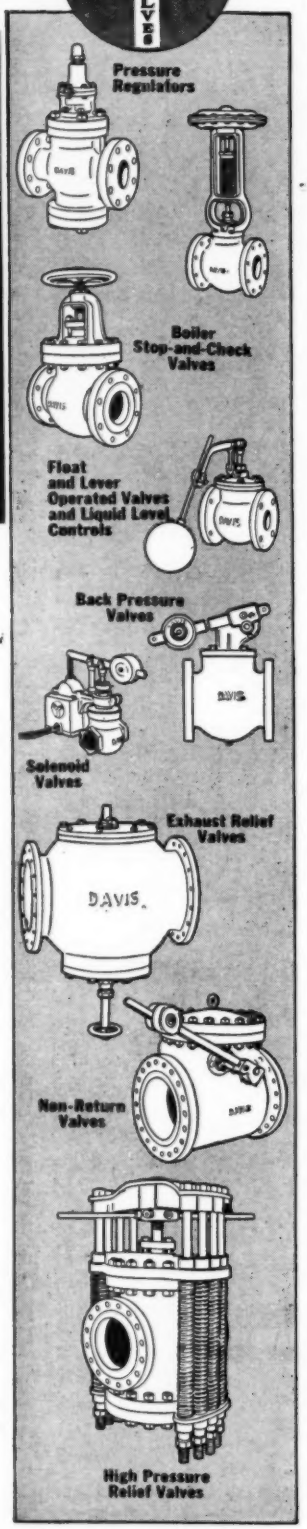
Built for Heavy Duty Industrial Service

DAVIS industrial-type Solenoid Valves are not to be confused with ordinary, low cost, commercial types. Davis products are engineered to handle the "tough jobs" on a basis of SATISFACTION GUARANTEED. The Davis line is complete—standard and special designs are available for every conceivable kind of automatic control application.

Our Engineering Department is always ready to assist in solving any problems regarding the use of Solenoid Valves. When submitting your problem, give complete information so that the proper valve may be selected for the service. State size of valve, whether globe or angle pattern, nature of fluid or gas, temperature, maximum and minimum pressures, service for which valve is to be used, whether valve is to be open or closed when solenoid is energized, standard or explosion-proof solenoid box and current characteristics.

No. 93 (illustrated above) is a self-contained, pilot operated, single seated, tight closing valve, built with full port opening to insure maximum flow with minimum pressure drop. Action is visible—may be operated by hand if current fails. Renewable valve disc. Sizes ½" to 4". Suitable for control service on steam, air, gas, water or oil lines.

DAVIS VALVES



DAVIS REGULATOR CO.

Representatives in All Principal Cities

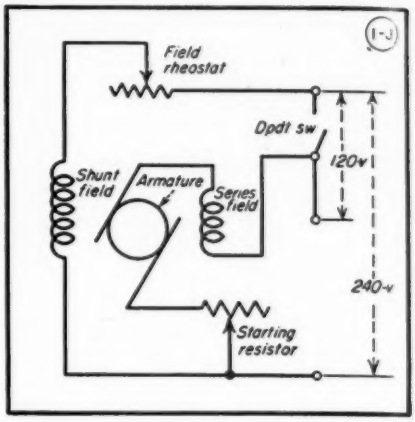
2540 S. WASHTENAW AVE., CHICAGO 8, ILL.

Reader's Problems

(*Continued from page* 116)

reduced armature voltage the regulation will be 600 to 1000 rpm.

By connecting a d-p d-t switch, as

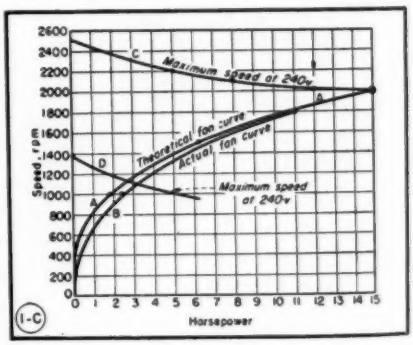


in 1-*J*, armature voltage may be changed from 240 to 120 with little difficulty.

HERMAN KORNAHRENS
St. Albans, N. Y.

Series Resistance Gives Good Operation

RLG SAYS HE DOESN'T WANT to use a series resistor with the armature of his 15-hp 240-v motor because it would waste a lot of power. A centrifugal fan's power requirements reduce as cube of the speed. Sketch 1-*C* shows



100% load (15 hp) at 100% speed (2000 rpm). At 50% speed, load is only 12½% (1.87 hp), and curve *A–A* is drawn on this basis.

I realize there is some friction load, so at 50% speed the power may not be 1.87 hp, but probably 2.5 hp. Curve *A–B* is drawn on this assumption. Shape of curve is also affected by shape and angle of the fan blades, but I have assumed that curve *A–B* is typical of a propeller or centrifugal type fan. At 700 rpm, which is the speed desired, load is only 1 hp so amount of power

FITTINGS ARE SCARCE as four-leaf clovers

. . . Save 7 per Trap with Super-Silvertops

WITH pipe fittings as scarce as 4-leaf clovers, more and more plants are "making fittings go farther" by simplifying their piping with Super-Silvertop Steam traps. These traps were the first inverted bucket traps to offer simplified piping and are still the only traps that give straight-in-line as well as alternate elbow connection throughout the complete size and pressure range. In the No. 19 through No. 346—from vacuum up to 700 pounds gauge pressure—you save as many as seven pipe fittings and as much as 60 minutes of installation time on every trap installed when you use Super-Silvertops.

Consider life expectancy, repair costs, trap capacity, delivered price and you'll see why Super-Silvertops should be considered for your trap requirements. Let us send you complete facts and figures—write today.

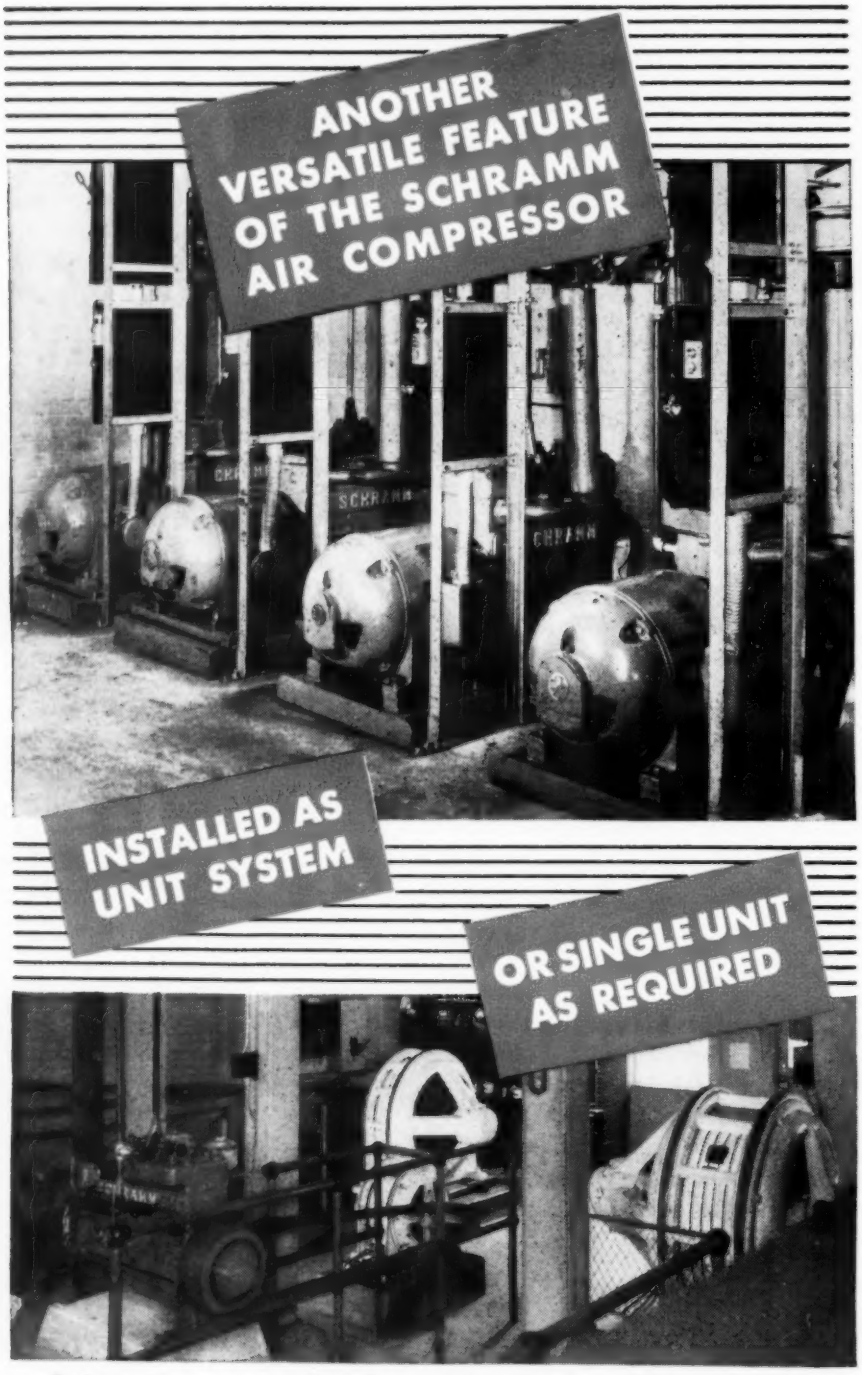
THE V. D. ANDERSON COMPANY
1934 WEST 96th STREET • CLEVELAND 2, OHIO

and here's how

Super-Silvertop showing one nipple and one union needed.

Conventional trap using seven fittings and two unions.

SUPER-SILVERTOP STEAM TRAPS



Today plants are installing Schramm Air Compressors either in unit systems or singly as required. Thus you see the versatile Schramm at work in a variety of plants, both large and small.

Regardless of your need for compressed air, there is a Schramm Air Compressor to do the work . . . the stationary units ranging in size from 2 to 600 cu. ft. displacement . . . the portable units (for use in construction work) from 20 to 420 cu. ft. of actual air.

Schramm features: 100% water cooled . . . mechanical intake valve . . . forced feed lubrication . . . compact, lightweight, *vibrationless*.

We invite inquiries and will send you free, detailed literature on Schramm Compressors—their construction features, uses, advantages. Write us today.

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

150 (802b)

wasted in a resistor in series with the armature is going to be much less than if the motor were carrying 15 hp.

If both 120- and 240-v power are available, however, it is possible to connect armature across 120 v and the field across 240 v. With the field getting full excitation and the armature running on about half voltage the speed is about one-half speed of curve *D*. This would give another curve almost parallel to *D*. This curve may not intersect *A–B* at 700 rpm, but it will come close. If field rheostat is adjusted properly 700 rpm is easily obtained.—*RFE*

Answers to Question 2

(*Continued from page* 117)

cleaned. We find that this schedule prevents unnecessary shutdowns. As plant electrician I list the date in a notebook as each overhaul is made.

Dayton, Ohio JOHN KIRIAKON

Work on Pump And Motor Together

IT DOES SEEM STRANGE to take impeller and shaft out of a pump just to remove the armature and bearings from the motor. Dismantling a pump starts trouble with wearing rings and bearings. If the pump is running right and only the motor needs repair, I always move the motor. Of course, great care must be used in realignment of couplings especially if they are the rigid type. *DBD* is right; it is easier to shift the motor than the pump.

Bronx, N. Y. GEORGE GRIFFEL

Best Plan Is To Remove Motor

DBD SHOULD TRY to install or change the shafting between motors and pumps so that a pump won't have to be disassembled to work on the motors. It is much easier to remove the motor than the pump when overhauling, but all engineers and maintenance men do not feel the same about this sort of repair.

Philadelphia, Pa. W T MULLEN

Always Realign Motors

THERE IS LITTLE VALUE in using someone else's repair schedule in your plant as operations vary so widely. Instead, keep a maintenance record on each unit and schedule it for future reference. Study each failure to prevent a reoccurrence.

Good records are essential if maintenance costs are kept to a minimum. It is a good idea to clean and check

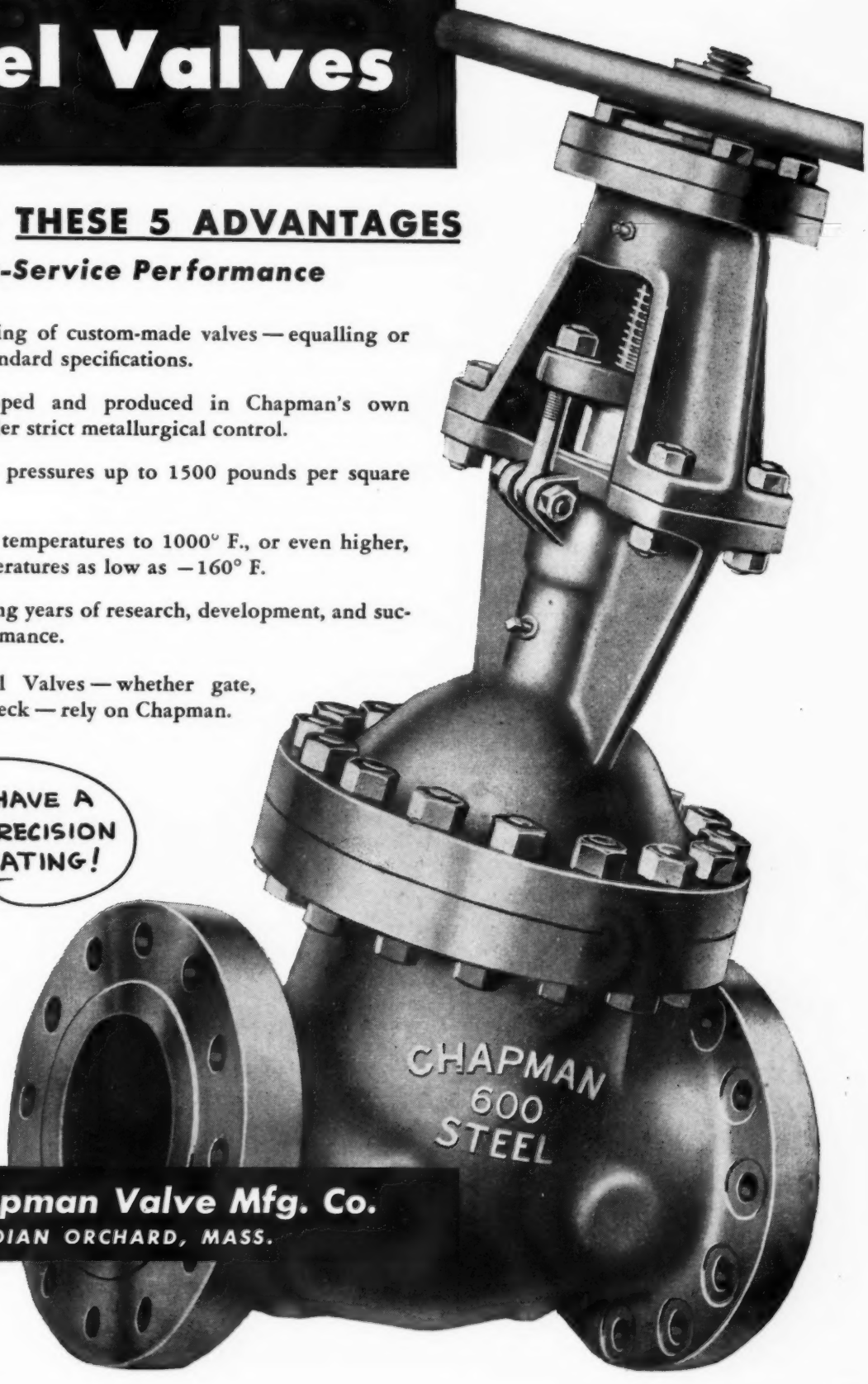
CHAPMAN Steel Valves

Give You THESE 5 ADVANTAGES

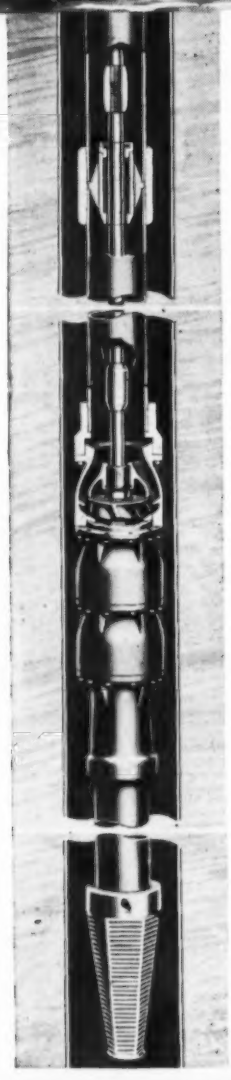
For Long-Service Performance

1. Precision rating of custom-made valves — equalling or exceeding standard specifications.
2. Steels developed and produced in Chapman's own foundries under strict metallurgical control.
3. Designed for pressures up to 1500 pounds per square inch.
4. Available for temperatures to 1000° F., or even higher, and for temperatures as low as −160° F.
5. Backed by long years of research, development, and successful performance.

If you need Steel Valves — whether gate, globe, angle, or check — rely on Chapman. Write today.



The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASS.



Install a Deming TURBINE PUMP

What is WATER costing your company? It's a question many companies are asking themselves in these days of mounting costs of doing business. Their search for ways and means of *reducing* costs wherever possible automatically leads to such items that CAN be controlled by proper action. The cost of WATER is one of those items.

Conclusive evidence that many companies, where Deming Deep Well Turbine Pumps are installed, are saving thousands of dollars annually is available to you upon request. In several cases, the complete cost of drilling a deep well, installing the Deming Turbine Pump, and all related costs of operation, maintenance, depreciation on the investment, etc., have been paid for by SAVINGS during the first year.

Deming Deep Well Turbine Pumps are built for wells 4" to 16" or larger. Capacities range from 15 to 3,000 gallons per minute. Features of construction are described in a 20-page, 8½" x 11" bulletin. Copy on request.

Write for illustrated BULLETIN 4700-B

THE DEMING CO.
204 BROADWAY
SALEM, OHIO, U.S.A.

DEMING
INDUSTRIAL PUMPS

the motor when the pump is overhauled. Align motor and pump shafts whenever either has been removed or new bearings installed. Previous dowlings cannot be depended on. Nearly always the motor should be moved to bring it in line with the pump.

Units should be carefully set originally, without any piping stress on the pump and with ¼ in. of shims under the motor feet. Then the pump can be left in place and the motor moved into line with it. A short piece of flexible conduit for the motor leads allows plenty of movement for alignment. Correct alignment eliminates wear in the flexible coupling.

The equipment-alignment method on p 106, August POWER, is good and lends itself to a high degree of accuracy. But a reasonably good job can often be done with a short straight edge and feeler gages.

Glendale, Calif. M L CRATER

Dissolved Silica

(*Continued from page* 89)

with a filter type of photoelectric colorimeter, a filter should be chosen that gives a high percentage transmission of radiation in the range between 370 and 410 millimicrons.

Instrument Calibration. To obtain graphs, as on p 89, we made up a known solution of silica in water. A weighed quantity of a ceramic material, having a known silica content, was placed in a platinum crucible with 1 gram of pure anhydrous sodium carbonate; the mixture was fused.

Product of fusion was dissolved into exactly 400 ml of distilled water in the same platinum crucible in which fusion occurred. It was then transferred directly to a carefully prepared and silica-free wax bottle.

Then 1-, 2-, 5-, 10- and 25-ml quantities of the solution were diluted to 25 ml and treated as previously described. Graph *A* indicates the relation between concentration of dissolved silica and density as read on the density scale of the quartz spectrophotometer, using distilled water as a reference and 10-mm absorption cells. Wavelength setting is 390 millimicrons although settings of 380, 390, 400, 410 and 420 were tried experimentally, Table I.

Graph *B* does the same for a filter type of photoelectric colorimeter using distilled water as a reference medium and 50-mm rectangular glass absorption cells. Two filters were used, one giv-

Burns ANY bituminous coal

Check these

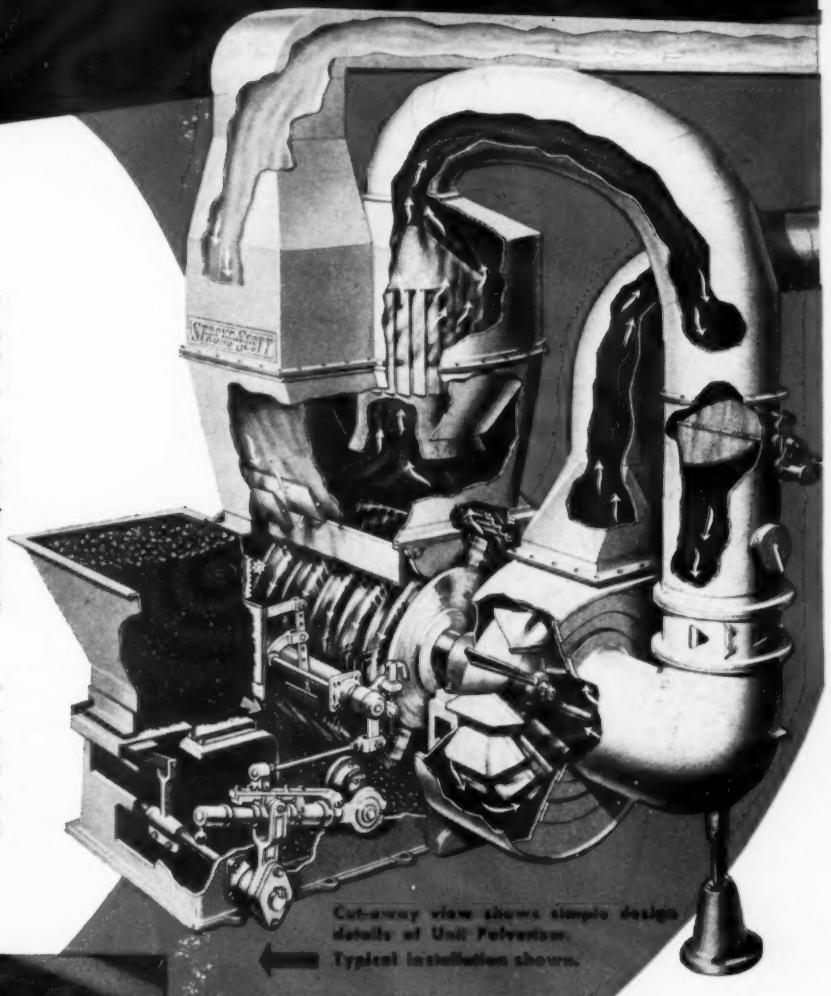
STRONG-SCOTT UNIT PULVERIZER

FEATURES

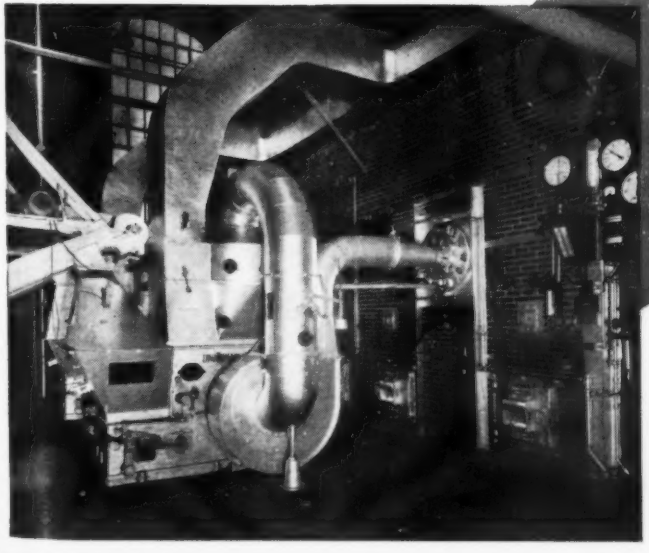
1. FIRES CONTINUOUSLY and uniformly under all conditions, with wet or dry, high or low grade coal, fine or irregular lumps up to 4″. Rotor can't clog or jam.

2. REQUIRES MINIMUM MAINTENANCE. Has simple design and rugged, long-life construction . . . . . only one motor runs *entire* unit. All repairs made *outside* of furnace. Pulverizing wear mainly in rotor-blades and fan-blades, of such simple design user may easily provide and install his own replacements.

3. PROVIDES MAXIMUM FLEXIBILITY. Adjustable fuel feed, air supply and fuel-air mixture meets fluctuating steam demands easily. Handles soft coal, lignite or by-product pitch with only simple adjustments. . . . . Adapted to direct-firing boilers, kilns or driers.



Cut-away view shows simple design details of Unit Pulverizer. ← Typical installation shown.



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With installations in more than 200 American cities, you can easily visit one close by. You'll find our customers our best salesmen.

When you buy a STRONG-SCOTT Unit Pulverizer, you acquire *dependability, service,* and the *assurance* that the company stands behind every guarantee made. Your investment will return reduced steam costs and fuel bills.

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Reduction in maintenance cost is important. Helicoid gages stay accurate longer and are the easiest to keep in calibration. That's why they have proved to be the least expensive gages to buy.

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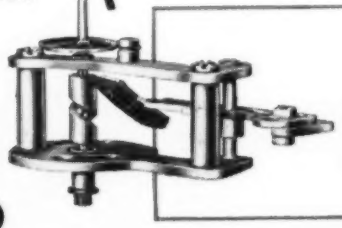

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TRADE MARK

ing maximum transmission at 380 millimicrons, and the other at 425, Table II.

At any rate, if an instrument is to be used it must be calibrated against known standards. For regular use all that is necessary is a standard silica solution. Then several measured volumes are diluted to 25 ml and treated as explained. Values so obtained are then employed as points on a graph, plotting the relation between silica concentration and the instrument's scale reading. Once this calibration has been made, it is practically permanent.

Except for occasional checks or blank runs on distilled water to test the reagents, routine analysis for dissolved silica is a matter of 8 to 10 min or, if desirable, large numbers of these analyses may be completed in an average time of 4 to 5 min each.

Instrument Selection. Choice of instruments must be based on the job, facilities available, and the relative initial cost and upkeep expenses. A spectrophotometer is essential in this analysis as well as in photometry research, for the development of new analytical procedures in the field of absorption spectroscopy, where a large number of different types of photometric analyses are to be made. The instrument ranges in price from several hundred to several thousand dollars, and skilled personnel are needed to operate it and maintain in good working order.

For less exacting requirements, or routine testing the filter type of photoelectric colorimeter is durable, inexpensive, accurate and easy to operate. These machines are entirely satisfactory for routine tests and some fields of research photometry. Price ranges from one hundred to several hundred dollars. Visual-type colorimeters, which are also usable, range in price from a few dollars to several hundred. Their accuracy depends on the skill of the operator.

Although the procedure just described operates with any of these instruments, accuracy and reproducibility of results require some form of photometer.

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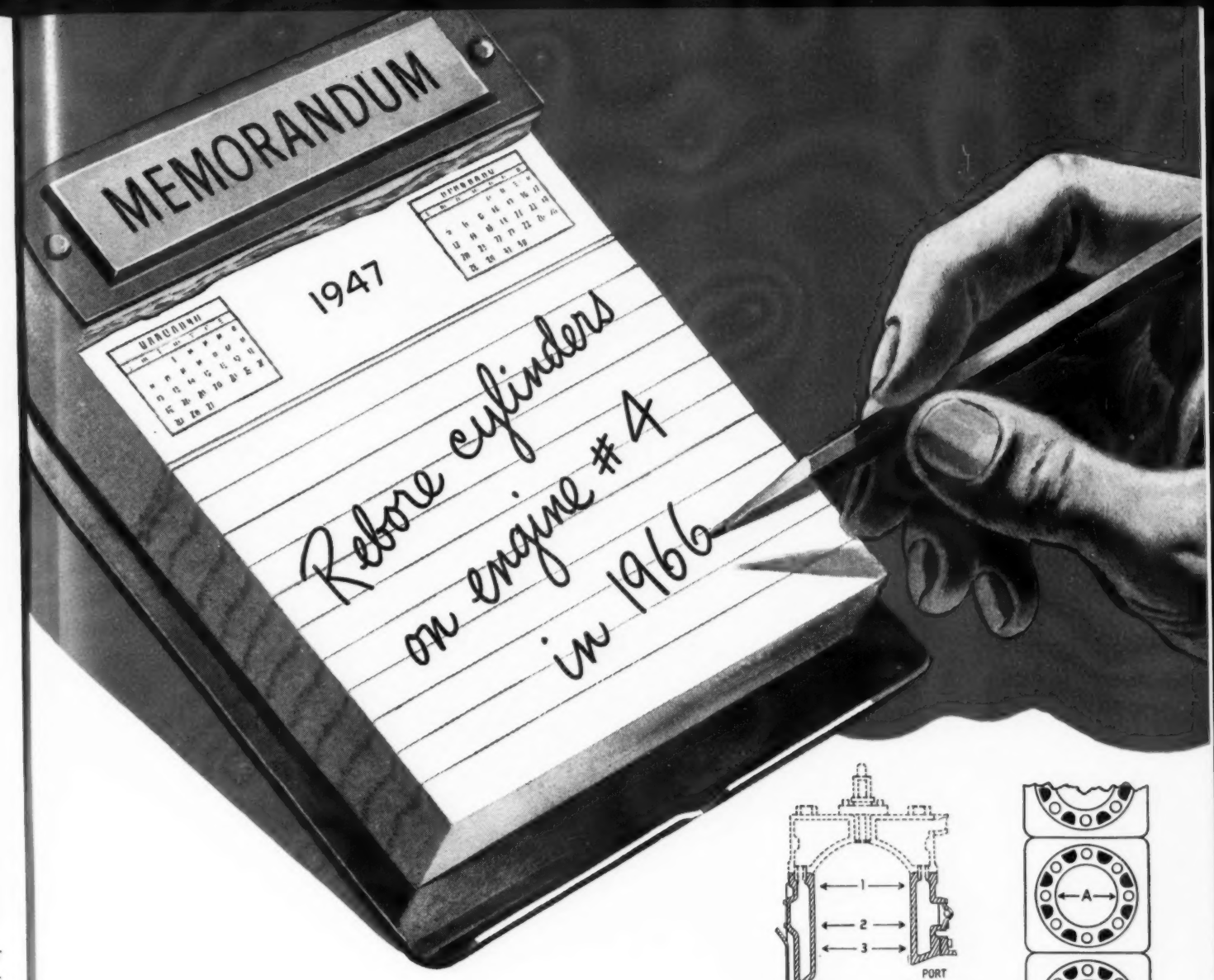
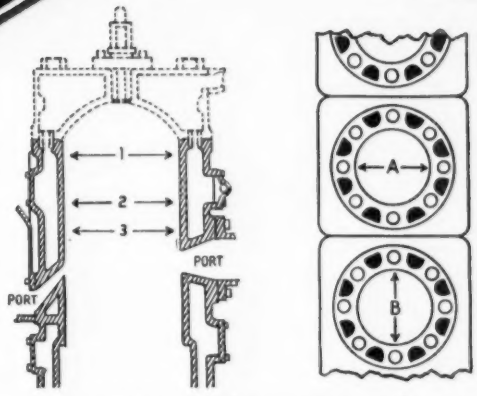


No cylinder reboring for 19 more years—114,000 hours! And that, on top of four years' operation—24,000 hours to date! That's the indicated service with Nonpareil HD Diesel Oil in a Fairbanks-Morse Model 33-E-16 engine at a midwest power plant.

The estimate of 23 years without cylinder reboring is based on the low wear during the first 24,000 hours of operation. Cylinder wear figures in the table at right show that with Nonpareil HD the maximum wear was only .014 of an inch. This is only half the normal wear in Diesel operation.

These figures prove that this heavy-duty, detergent oil can greatly increase the life of Diesel cylinders. Compare your records with this typical instance of the remarkable performance of Nonpareil HD in low-cost Diesel operation. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.



Four-year cylinder-wear record on ten-cylinder Model 33-E-16 F-M Diesel

Key to Measurements in Table

(A)—At right angle to crankshaft
(B)—Parallel to crankshaft
(1)—One inch below top ring travel
(2)—Half way between top of cylinder and top of ports
(3)—One inch above ports

Average wear on all 10 cylinders

	A	B
(1)	.012″	.011″
(2)	.010″	.006″
(3)	.014″	.011″

Engine manufacturers recommend that cylinders be rebored when wear reaches .080″.

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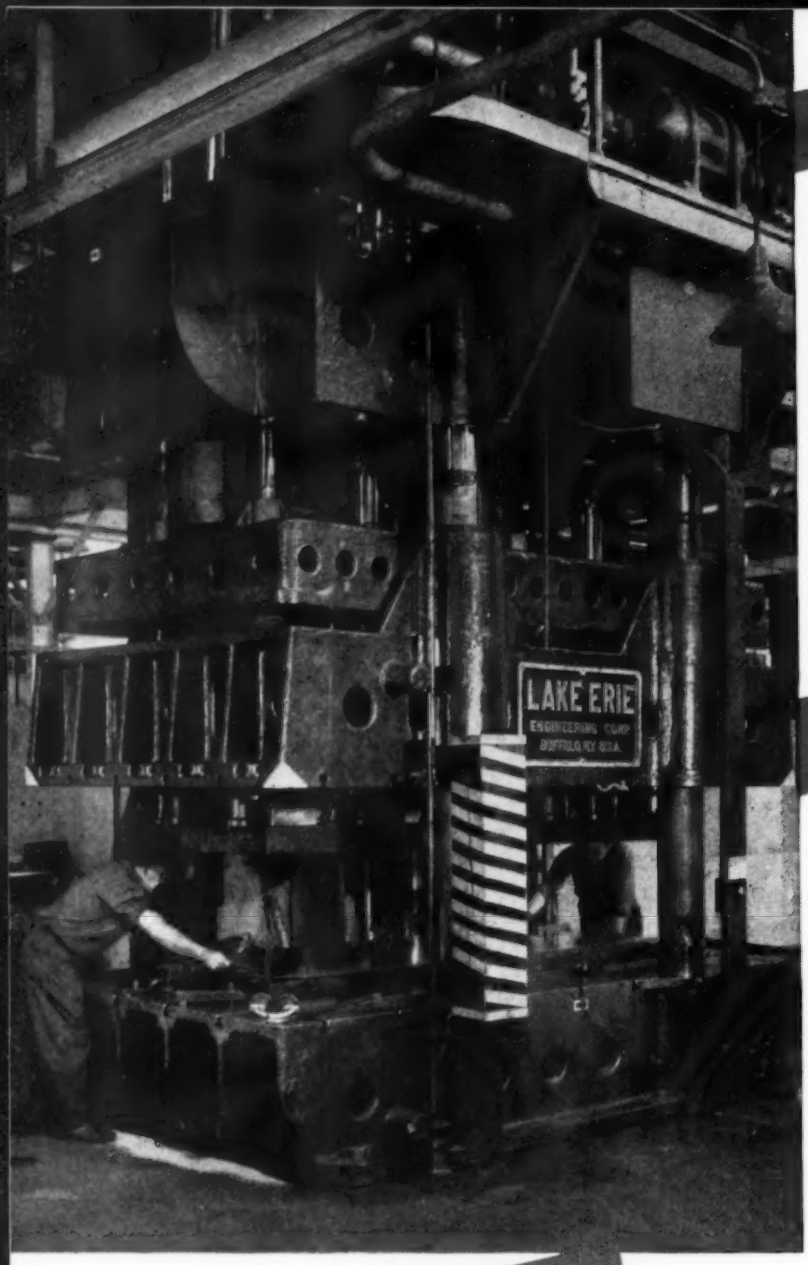

Tests prove hydraulic oil "like new" after three years' operation

January 1944, Stanoil was placed in a large hydra press, newly installed at the Flour City Ornamental Co., Minneapolis.

June 1947, a laboratory inspection was made of original fill of Stanoil, then in its fourth year of al continuous service. Below are the significant test figu

Viscosity (SUV @ 100°F.) . .	303 seconds
Oxidized oil	.01%
Color Increase (NPA)	½ unit

The viscosity figure of 303 seconds was within the oil specification range of 300-310 seconds. This fact, the extremely low per cent of oxidized oil and the s color change, indicated that there had been practicall oxidation of the oil in three years. Because of these fac the hydraulic system stayed clean and the hydraulic trols functioned smoothly on this press at all times.

Stanoils contain an oxidation inhibitor and an anti-f additive which give these oils long life and reliable o ating quality in hydraulic systems, as well as in circula systems, speed reducers and similar equipment. A St ard Oil Lubrication Engineer will help you put this nomical oil to work in your plant. Write Standard Company (Indiana), 910 South Michigan Avenue, cago 80, Illinois.

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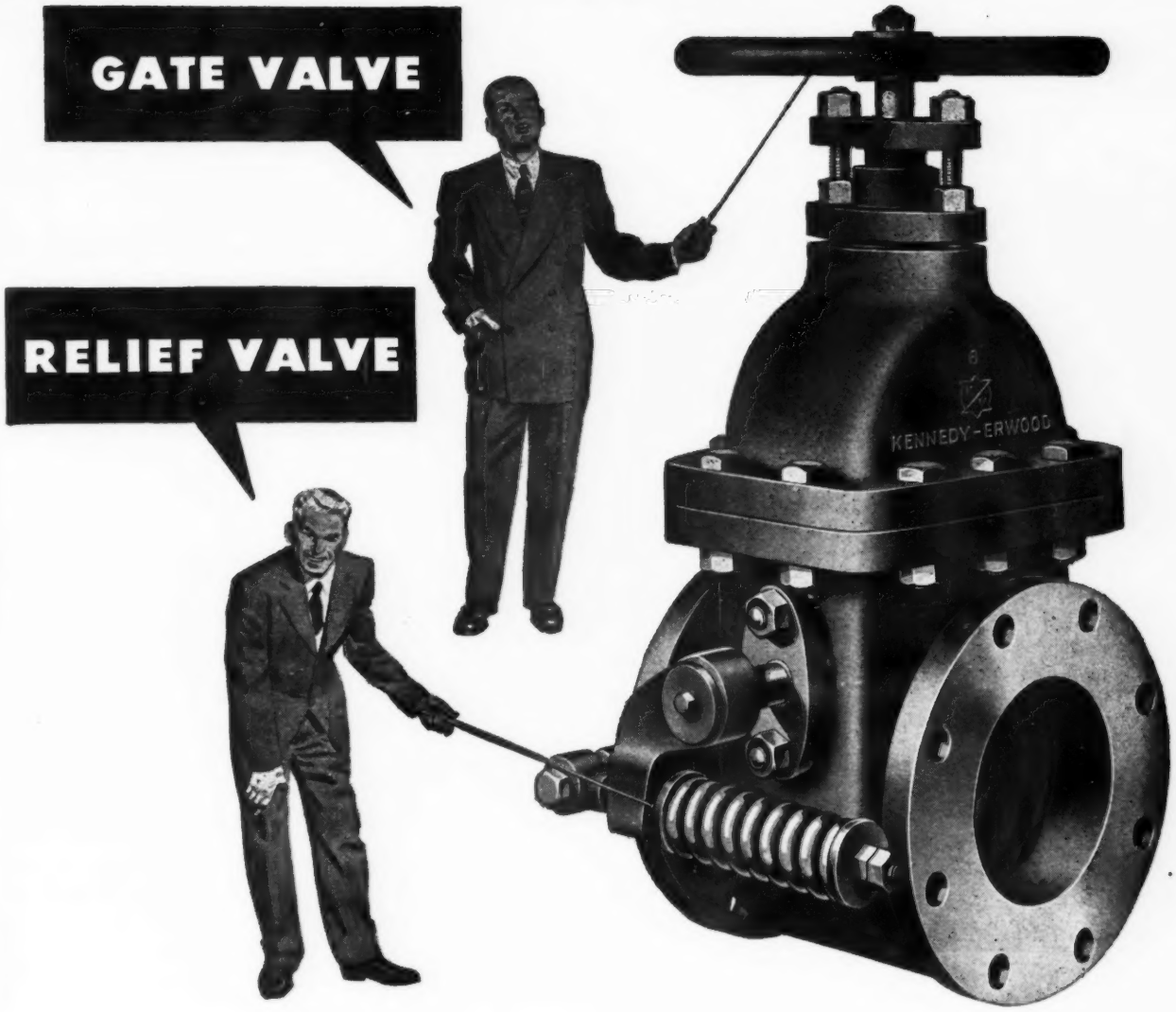

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For normal operation, the Kennedy-Erwood Valve can be manually opened and closed, just like a standard gate valve. However, if the back pressure exceeds an amount that would be dangerous for the apparatus which the valve is to protect, the predetermined spring pressure permits the disc to open and relieve the pressure. Therefore, it also functions as an automatic relief valve.

Wherever low-pressure apparatus is to be protected from excessive pressure, the Kennedy-Erwood Valve is an essential insurance against the possibility of costly damage. It is widely used for this purpose by central power generating stations and manufacturing and process plants.

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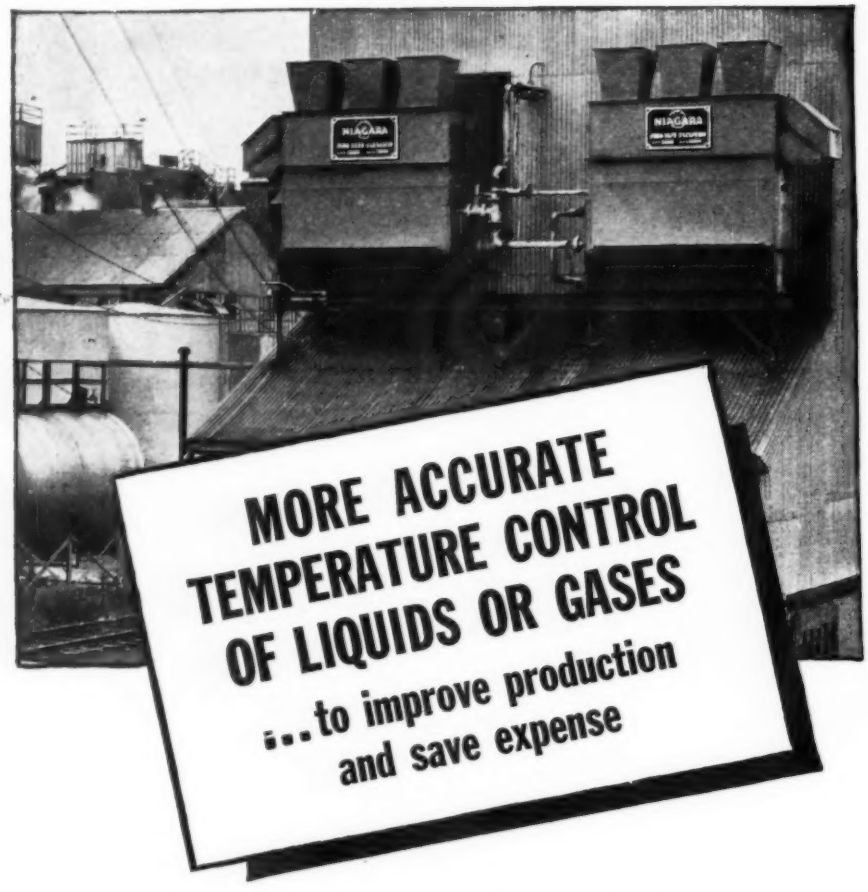

● The Niagara Aero Heat Exchanger is used as a liquid or gas cooler in many industrial processes such as cooling jacket water for engines or process equipment; cooling lubricants, cutting oils, quenching baths, electronic sets, transformers, controlled atmospheric processes; condensing of steam, vapor, acid gases; compressed air or gas cooling.

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Acknowledgments

Dr A C Titus, J E Scott, and G G Zeh, chemical section, Works Laboratory, General Electric Co, Schenectady, N. Y.

Pump Q and A

(*Continued from page* 122)

Q 29—Are rotary pumps recommended for liquids which contain solids?

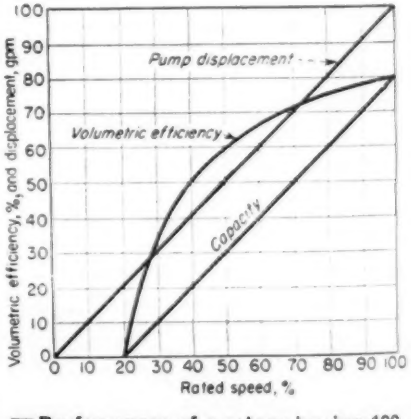
A—They are not, if the solids are hard and cannot be melted because they clog and abrade the closely fitting parts of most rotary pumps.

Q 30—What is the action of corrosive liquids on rotary pump parts and performance?

A—A small amount of corrosion will be sufficient to roughen the finished surfaces of their closely fitted parts and cause premature wear. This increases the clearance and loss of capacity.

Q 31—What happens if a rotary pump on low viscosity liquid is operated at low speed?

A—Fig. 7 shows the performance of



7 Performance of a rotary having 100-gpm displacement at 100% speed and 20% slip at this speed. Operated at 20% speed, pump fails to discharge

a rotary pump having a displacement of 100 gpm at 100% speed. Assume this pump to have a slip of 20% at

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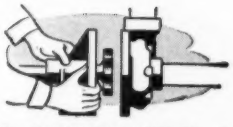
BUY IT "OFF THE SHELF" Pump can be bought "bare" or as a complete unit: pump, motor, Texrope drive and welded steel base. Also can be coupled or belted to a motor, a gasoline engine or power take-off which you already have.



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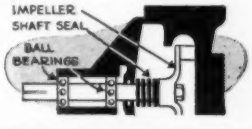
INTERCHANGEABLE CASING AND IMPELLER—1" by 1", 2" by 2" and 3" by 3" sizes differ only in impeller and casing. Pedestal casting, shaft, ball bearings, mechanical seal and impeller nut are the same in all sizes.



QUALITY CONSTRUCTION—Two large ball bearings, grease sealed ... High grade mechanical shaft seal ... Heavy 1 in. machined shaft, with keyways and impeller lock nut ... Bronze open type impeller ... Heavy, generous design throughout.

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100% speed, then capacity under the assumed pressure conditions is represented by the capacity line parallel to the displacement line. If this pump were operated at 20% normal speed, it would cease to discharge. Volumetric efficiency as shown is low at speeds below 50% normal.

Q 32—What are some of the liquids handled by rotary pumps in power plants and public utilities?

A—They are used to circulate or transfer all grades of diesel and fuel oils, lubricating oil and greases, gashouse tars and asphalts, paints and butane, gasoline and kerosene, and small-capacity water circulation.

Supercharged Diesels

(*Continued from page 80*)

first addition. By the tenth year another unit must be added to the nonsupercharged plant, bringing firm capacity up to the ultimate of 3000 kw for which both plants are designed. It will be three more years before another unit will have to be added to the supercharged plant. At completion of the plants the saving in investment increases to $112,740, with a substantial reduction in interest payments. The comparison thus shows a clear advantage for the supercharged plant.

Fuel-Gas Savings. So far consideration has been given to diesels operating only on fuel oil. The advent of supercharged engines able to operate on gas as well as oil fuels broadens the scope for savings in power production, by putting the user in a position to take advantage of differences in fuel cost. Let's go one step farther, and consider the possibilities for additional savings with supercharged engines operating on fuel gas and the minimum amount of pilot oil necessary for ignition.

The last set of curves shows comparative costs of fuels between half and full loads. Referring back to the tabulation of fuel consumptions for the two types of plants, we see that the running-engine-capacity factor of the 1000-kw supercharged engines is 49.8% in producing 4,361.750 kwhr. With oil at 7.0c per gal, we find by interpolating in the comparative fuel-cost curves that this amounts to $5.35 for each 1000 kwhr generated. With gas at 20c per 1000 cu ft, and pilot oil 7.0c per gal, the total fuel cost would be $2.90 per 1000 kwhr. The saving with the gas diesel operating on 20c gas compared with

15 Features
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1. Meter range or capacity for any given ring, may be adjusted conveniently without rebuilding the assembly.

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3. The full scale differential is independent of the net density of the sealing liquid. No correction is needed for water on mercury, etc.

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8. High accuracy in the conversion of differential head to pen movement at low flows is assured by the unique spring resistance system.

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10. No stuffing boxes are used in Ring Balance Meters.

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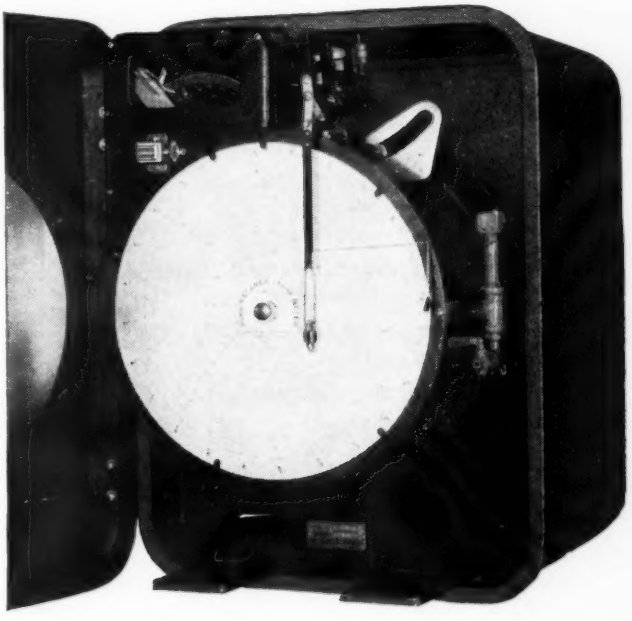
12. Over-range operation troubles encountered in ordinary meters are eliminated.

13. The meter assembly is completely housed in a dust-tight case.

14. Skid rails permit the assembly to be shifted forward and backward in the case for inspection of all parts without disconnecting any part. Also, the entire assembly may be removed conveniently from the case.

15. The integrator is a simple accurate unit, easily checked. The readings are totalized on a counter which can be read without opening the case.



These features explain why more and more plants are standardizing on Hagan Ring Balance Meters. Hagan Corporation, HaganBuilding, Pittsburgh, 30, Pa.

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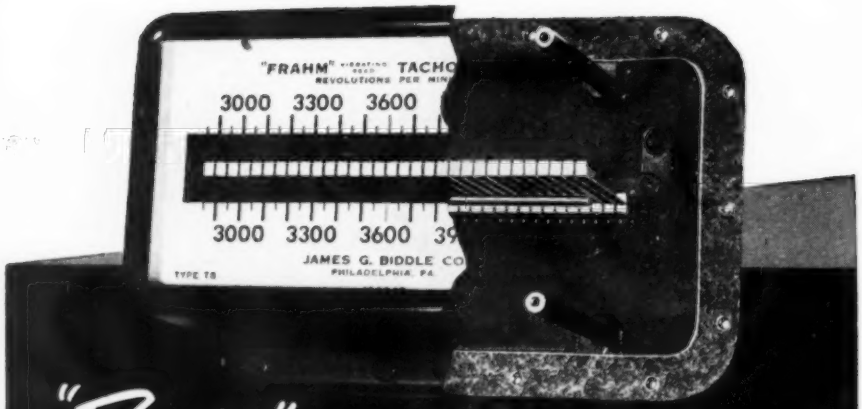

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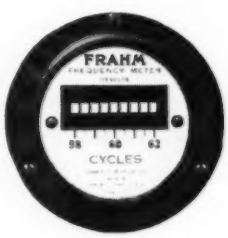

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the regular diesel on 7.0c oil is thus $2.45 per 1000 kwhr.

In generating 4,361,750 kwhr the saving comes to $10,686.28. With the engines arranged to operate as gas diesels and costing slightly more than oil diesels (about 5% of the third item in the investment-cost tabulation) the saving will repay the additional investment in the first year. Further savings will be clear profit and as the running-engine-capacity factor increases the savings will mount from year to year.

Charles E Oakes, president of Edison Electric Institute, said recently, in announcing publication of the industry's *Statistical Bulletin* covering operations of the year 1946, that electric light and power companies will spend five billion dollars in the United States on construction within the next five years. Construction volume by the locally operated electric-power companies has already accelerated to rate of a billion dollars a year. This rate is expected to be maintained throughout this year and during the following four years.

The total amount is more than one third of the present entire capitalization, $13,000,000,000, of the 65-year old business-managed electric industry. It will add more new generating capacity to local company plants than is presently installed in all of the government-owned power projects, including Tennessee Valley Authority, Boulder Dam and Bonneville.

About 95% of the new generating installations will consist of steam plants using coal, oil or gas. Despite the large increase in governmental hydroelectric developments in recent years, installed capacity of all water-power plants still comprises less than 30% of total generating installations. In 1936 it was 29%, and in 1926 27%. Within the next three or four years the percentage will probably drop below the 1926 figure.

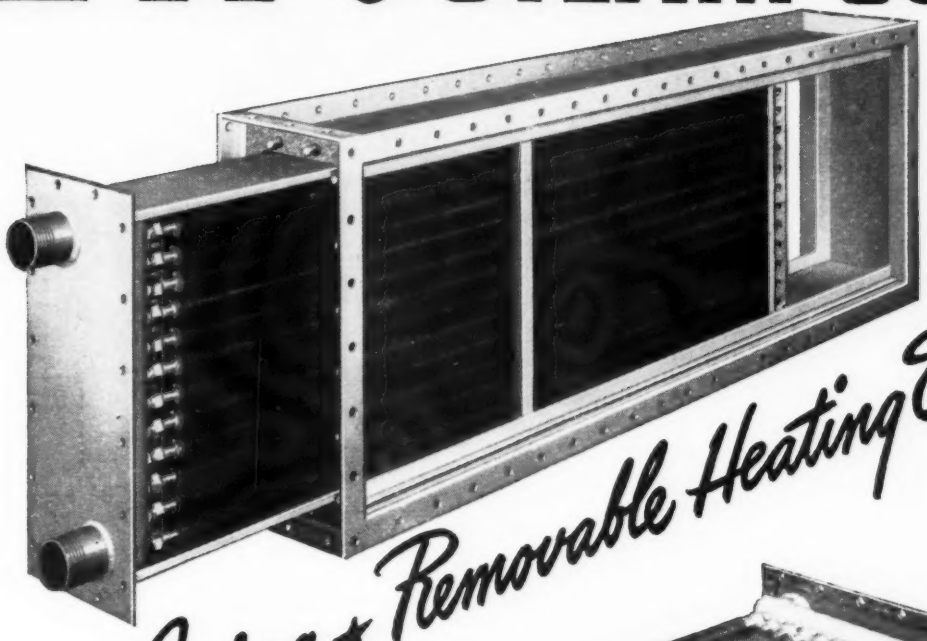
The electric light and power industry completed one of the most active years of its history in 1946, the *Statistical Bulletin* states. Total sales of current by all utilities—public and private—approximated 191 billion kwhr.

Winnipeg Electric Co power-extension project at Seven Sister Falls is proceeding according to schedule, company officials indicated recently. This development will add 50,000 hp to the company's power capacity and is scheduled to be finished in June 1948. Wet weather has interfered with this work to some extent.

Dr J T Rettaliata, director of dept of mechanical engineering of Illinois Institute of Technology and engineering consultant for Allis-Chalmers Mfg Co, addressed the American Institute of Electrical Engineers in Mexico City on Aug 28 on the subject, "Gas Turbines and Jet Propulsion."

Immediate construction of a 160,000-hp power development at Chenaux Rapids on the Ottawa River will be undertaken by the Ontario Hydro-Electric Power Commission at a cost of $200,000,000.

NEW! HEAVY DUTY STEAM COILS



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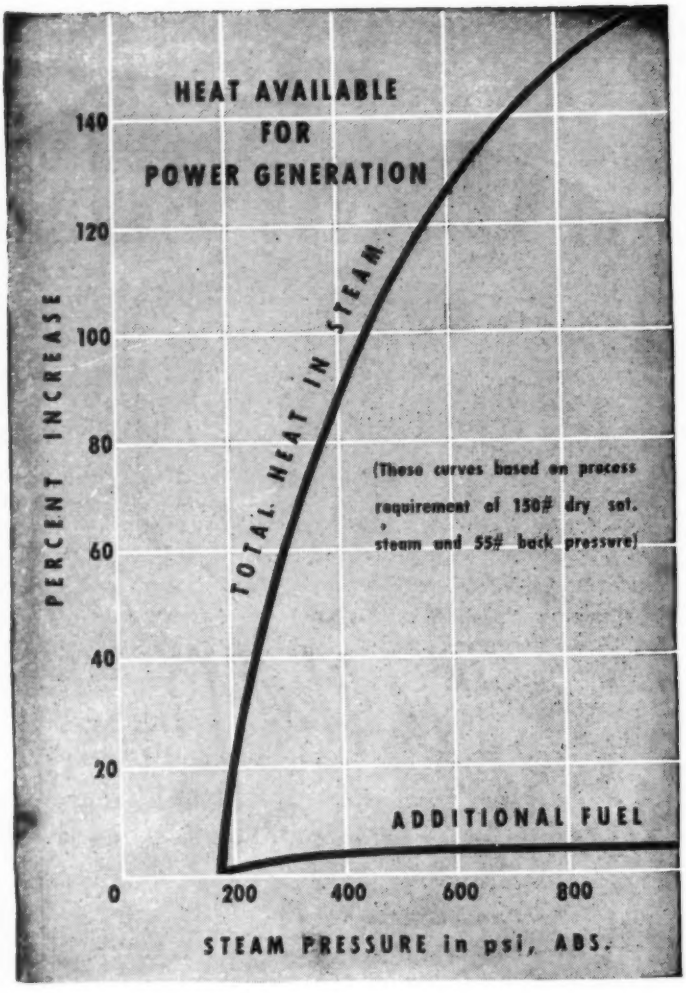


Here's "By-Product Power" ...AT LOW COST

Many plants are producing low-cost power from process steam *before* delivering it to process equipment. Here's one way it's done! Steam, at full boiler pressure, is delivered to extraction or back-pressure turbines and power is generated — at little more than the cost of operation and maintenance of generating equipment. The bled steam can then be piped direct to meet process needs.

A Kuljian Survey will determine quickly the extent to which such opportunity exists in your operations. Kuljian Engineers have specialized for years in power plant design and construction. It may pay your company large dividends to take advantage of this service. Your inquiry is invited, now.

The **Kuljian** *Corporation*

ENGINEERS • CONSTRUCTORS

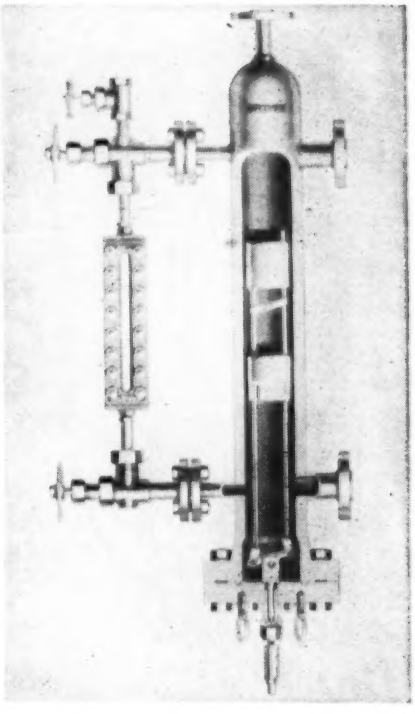
1518 Walnut Street, Philadelphia 2, Pa.

New York 6 • Washington 5

New Equipment

(*Continued from page* 146)

where chain emerges from pipe and discharges load while making vertical turn on driving sprocket. Conveyor, electric-motor driven through chain, sprocket and gear speed reducer. **Honan-Crane Corp, 200 Superior Ave, Lebanon, Ind.**



Water Column E111

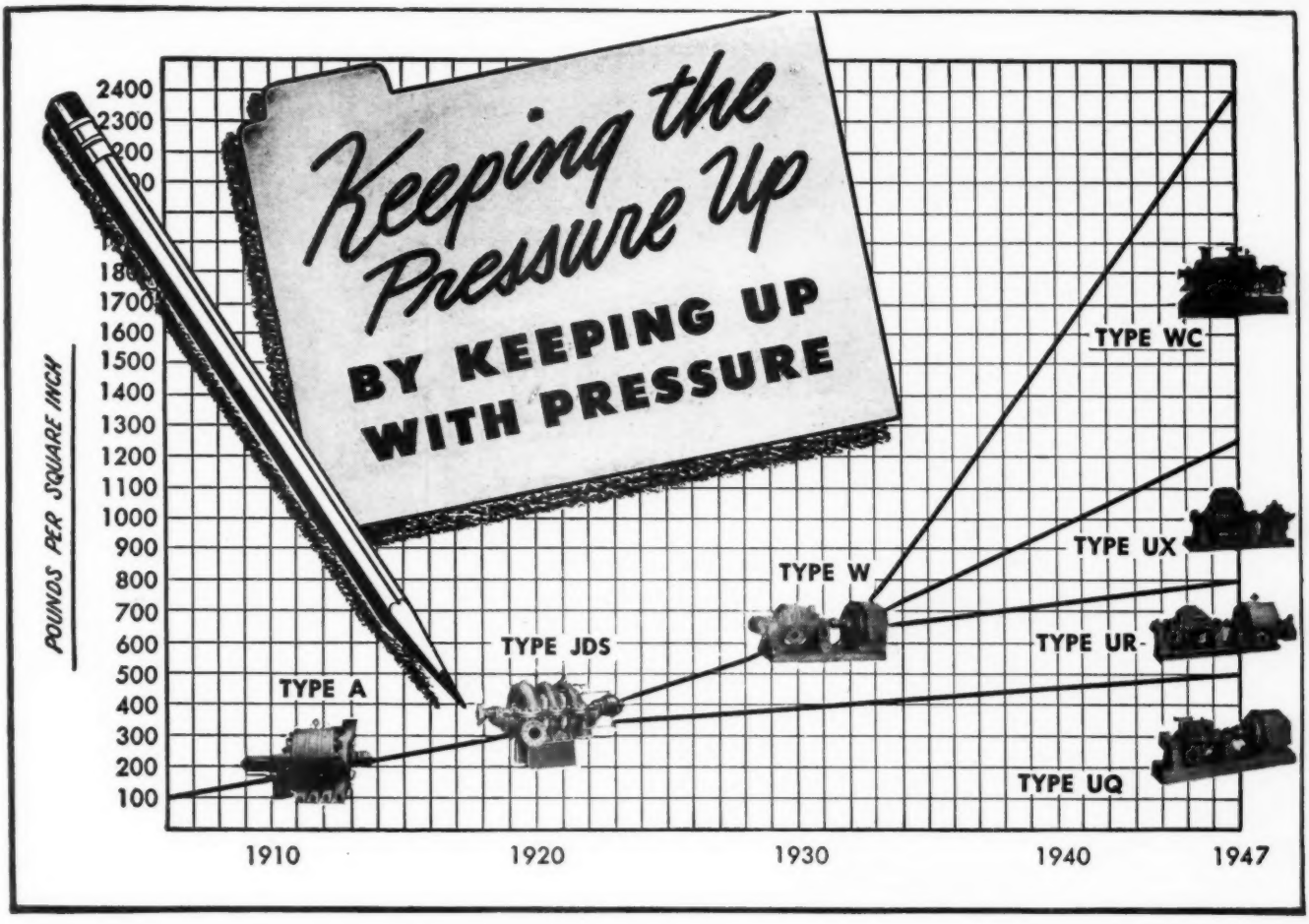
WATER COLUMN with low- and high-water alarm uses solid displacement weights balanced on stainless-steel knife-edge supports. Alarm mechanism is stainless steel throughout. Available in five models, 300, 450, 600, 900 and 1500 psi. **Jerguson Gage & Valve Co, 87 Fellsway, Somerville 45, Mass.**

Arc Welder E112

THE HEAVY-DUTY single-operator type *WD*-40 series electric welders, operating at 3500 rpm, is available in 200- 300- and 400-amp NEMA ratings. New single-dial control makes it possible for the operator to preset at the correct current for any given job without having to make other adjustments after the arc is struck.

With this current presetting arrangement, a tap switch handle in the form of a pointer is set to the electrode size being used. It then automatically points out the proper one of several graduated scales on the face of the current-setting dial. This indicates the current range to be used and permits adjustment of the welder output.

Standard assembly includes a stationary welding generator, driving motor, control cabinet and panel, and a motor starter



The graph shows you how closely Worthington has kept pace with industry's demands through the years . . . by developing centrifugal pumps to handle steadily mounting boiler feed pressures.

It's a record of steady progress . . . from the old Type A, a great performer at 200 psi . . . to the powerful modern Types WC, UX, UR and UQ, with pressures ranging from 2½ to 12 times the 1910 "ceiling".

THE LONGEST AND BROADEST EXPERIENCE

In addition, out of Worthington's more than 100 years of pioneering in pump design and manufacture have come such notable improvements as the Elastic Seal Ring for tight interstage joints in axially split-case pumps . . . the Metal-to-Metal Ring Type Joint in solid-case barrel pumps.

FOR YOUR OWN BOILER FEED REQUIREMENTS

Worthington has the most complete line of centrifugal pumps — all pressures, all capacities — and engineers trained to fit feed pump to feed cycle for maximum economy and dependability.

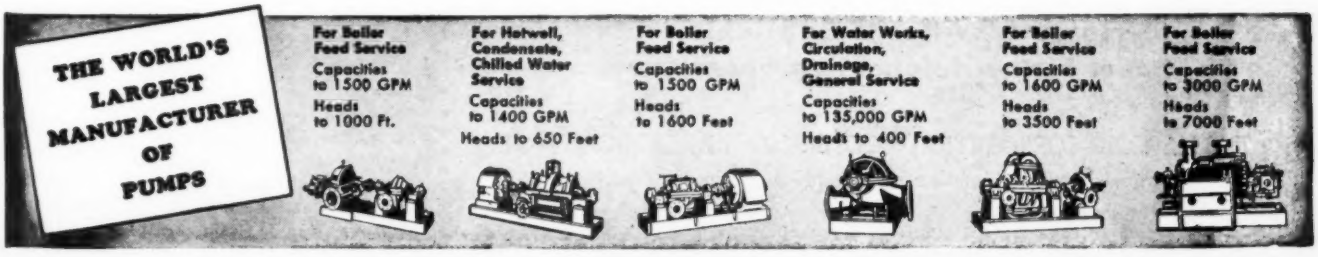
For details that prove *there's more worth in Worthington*, contact our nearest District Office. Or write to *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

MEMBER

WORTHINGTON

C7-9

THE WORLD'S LARGEST MANUFACTURER OF PUMPS


For Boiler Feed Service
Capacities to 1500 GPM
Heads to 1000 Ft.
For Hotwell, Condensate, Chilled Water Service
Capacities to 1400 GPM
Heads to 650 Feet
For Boiler Feed Service
Capacities to 1500 GPM
Heads to 1600 Feet
For Water Works, Circulation, Drainage, General Service
Capacities to 135,000 GPM
Heads to 400 Feet
For Boiler Feed Service
Capacities to 1600 GPM
Heads to 3500 Feet
For Boiler Feed Service
Capacities to 3000 GPM
Heads to 7000 Feet

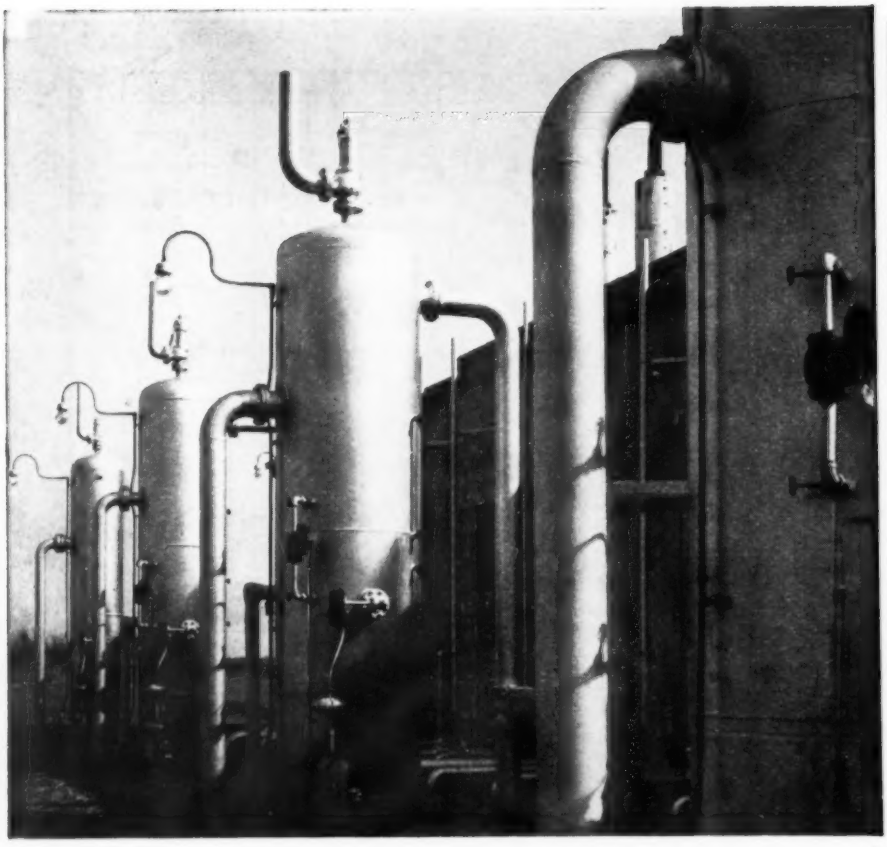


PHOTO SHOWS LIQUID LEVEL CONTROL INSTALLATIONS

Mercoid Controls
on the
Highways and Byways
of
Industry

Designed to automatically regulate electrically operated equipment in accordance with changes in temperature, pressure, vacuum, fluid level or mechanical movement. Equipped exclusively with corrosion-proof mercury switches. Various types of mercury switches available to the trade. Further information upon request.

THE MERCOID CORPORATION • 4201 BELMONT AVE., CHICAGO, ILL.
Manufacturers of dependable automatic controls for a quarter of a century

assembled in a single, compact unit. **A 2-wheeled running gear is an optional feature. General Electric Co, Schenectady 5, N. Y.**

Swivel-Hook Assembly E113

DROP-FORGED REPLACEMENT swivel-hook assembly for wire-rope and chain fittings has improved safety latch. When released, safety latch, on conventional styles of hook, leaves 70% of hook throat open. Latch will not open until released by operator. A graphite-impregnated bronze washer under the hook nut assures easy swivel action. Heat-treated alloy swivel bolt gives high strength and long life. Hooks are available in ½- and 1-ton sizes and are recommended for crane, hoist and lashing applications. **Thomas Laughlin Co, Portland 6, Me.**

Welding Electrode E114

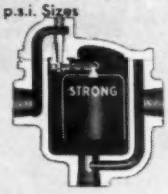
EUTECTRODES, 67 ac and 670 dc, have a high alloy content developed for joining, filling, filleting and overlaying all types of steel where requirements call for high tensile and impact strength; good heat, corrosion and wear resistance; and high hardness. They can also be used as an overlay material on cast iron. Letters after the numerals specify type of welding current for each rod. Electrode 67 is available in diameters of $\frac{3}{16}$, $\frac{5}{32}$, ⅛ and $\frac{5}{32}$ in. **Eutetic Welding Alloys Corp, 40 Worth St, New York 13, N. Y.**

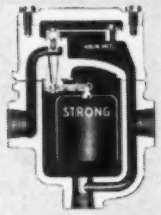
Running-Time Meter E115

DESIGNED FOR USE ON AC circuits, this meter automatically registers total operating or idle time of any circuit, machine or system to which it is connected. Typical applications include use to indicate total hours of operation of automatic pumps and machines, forecasting need for servicing and parts replacement, and checking oper-

Inverted bucket trap. All stainless fitted. To 250 p.s.i. Sizes ½" to 2½".

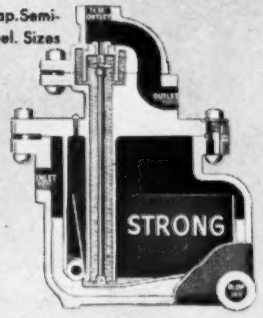
Inverted bucket in-line trap. To 250 p.s.i. Sizes ½" to 1".





Inverted bucket blast trap (thermal air by-pass). Sizes ½" to 1".

Open bucket trap. Semi-steel or cast steel. Sizes ½" to 3".



Ball float trap for draining air line or venting service. To 200 p. s. i.

HERE'S WHY YOU SHOULD BRING YOUR STEAM PROBLEMS TO STRONG

1. Over 40 years' specialized *engineering experience* in all types of steam problems;

2. Completeness of the STRONG line gives you the added advantage of choosing *exactly* the *right* size and type of steam specialty to meet your *individual* need;

3. Acceptance of STRONG products as *standard* by outstanding engineering firms and large users;

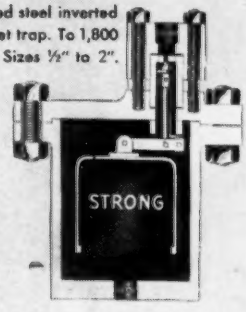
4. Advanced engineering design to maintain *leadership* in the field.

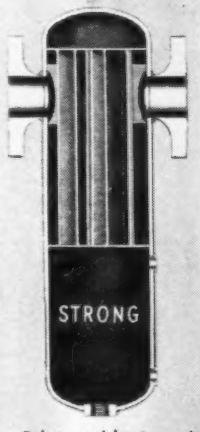
Insist on genuine STRONG steam specialties and repair parts for reduced maintenance and increased production. A large staff of STRONG factory-trained field engineers is at your service. Bring your next steam problem to STRONG*.

STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3rd Street . Cleveland 13, Ohio

*Trade Mark Reg., U.S. Pat. Off.

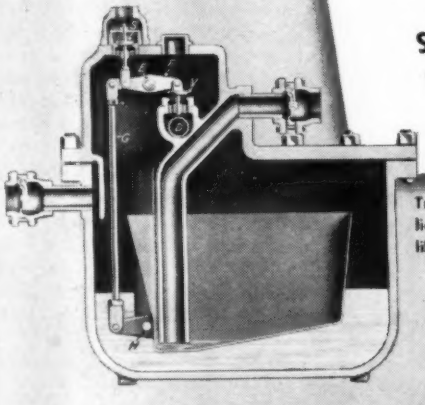
Forged steel inverted bucket trap. To 1,800 p.s.i. Sizes ½" to 2".





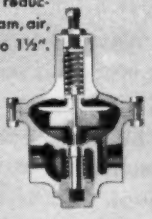
Fabricated horizontal or vertical steel separator. Sizes ½" to 10".

Pilot operated pressure regulator for steam, air, gas. Sizes ½" to 4".



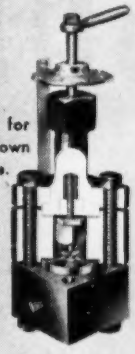
Trap for removing liquids from vacuum or lifting (pumping) service.

Direct operated reducing valve for steam, air, gas. Sizes ⅜" to 1½".



Quick cleaning strainer. Semi-steel and cast steel. Sizes ⅛" to 4".

Block steel valve for continuous blowdown or throttling service.



REG. TRADE MARK

SPECIFY

ANUM-METL Reg. Trade Mark

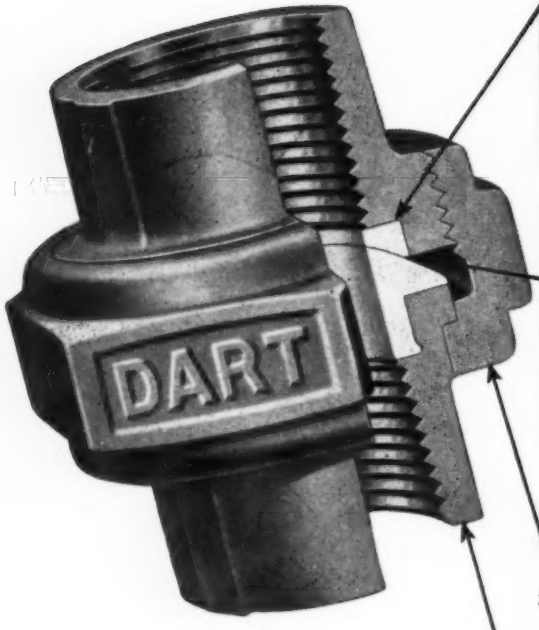
STRONG STEAM SPECIALTIES

SEND FOR THESE CATALOGS

←No. 155 Regulating Valves

No. 67→ Traps

No. 102→ Continuous Blowdown



2 BRONZE SEATS
Precision Ground
Non-Corroding

TRUE BALL JOINT
Drop-Tight
Leak-Proof

EXTRA-HEAVY SHOULDERS
Withstand strains
and abuse

MALLEABLE IRON BODY
Practically
indestructible

These Quick Facts Show

DART SUPERIORITY

Dart Unions maintain an absolutely tight seat seal. This tightness of seal is based on the two precision-ground bronze seats which form a true ball joint. Since the seats are bronze, they're non-corroding; and since they form true bearing surfaces, they're leak-proof. Darts require no packing and can be easily uncoupled for use in other locations. Body and nut are practically indestructible because they're made of high-test, air-refined malleable iron.

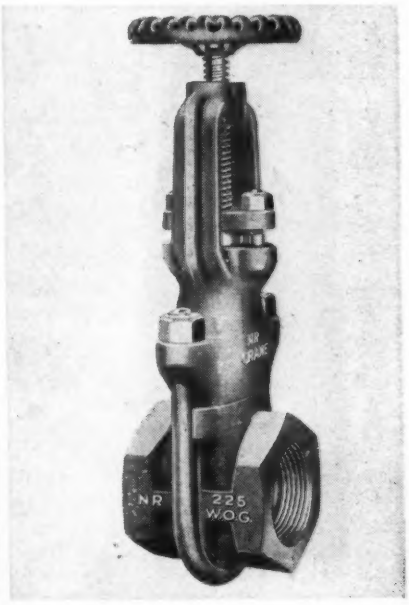
Ask your supplier to demonstrate Darts.

E. M. DART MFG. CO.
PROVIDENCE 5, RHODE ISLAND

DART UNIONS

ating time of equipment under test. The unit has a precision-built 5-digit revolution-type counter, which indicates in tenths up to 10,000 hr, then repeats itself.

Running-time meters with reset features are available in three models. Type *E5* furnished in attractive die-casting, is suitable for table use. Type *E6*, inclosed in metal housing, arranged for conduit connection, is complete with hinged cover. Type *E7* is a 3¾-in. diameter instrument inclosed in combination die-cast and bakelite housing for flush-panel mounting. It is equipped with knob reset, accessible from the front. **R W Cramer Co, Centerbrook, Conn.**



Gate Valves E116

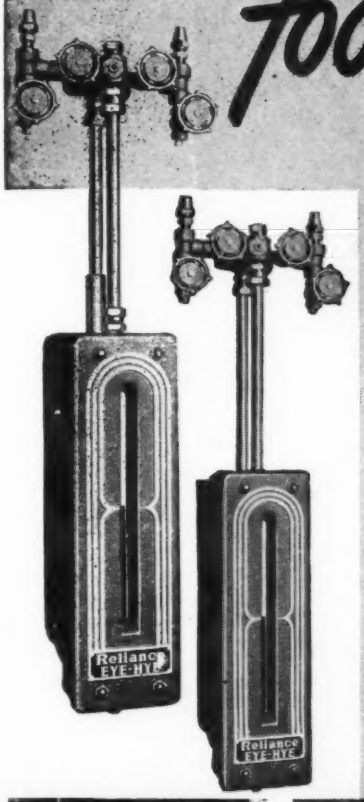
REINSTATEMENT of the line of *Ni-Resist* cast-iron gate valves, discontinued during the war, is announced by the manufacturer. Valves have wedge disk, outside screw and yoke, and are furnished with screwed ends in sizes from ¼ to 2 in., and with flanged ends from 1 to 8 in. Valves in 3-in. size and smaller have a clamp-type bolted bonnet.

Body and bonnet of all valves, disks in 4-in. size and larger, and the gland in 3 in. and smaller, are made of *Ni-Resist*. Stem and body seat rings, the disk in sizes 3 in. and smaller, and disk facings 4 in. and larger, are made of Crane 18-8 alloy steel. **Crane Co, 836 S Michigan Ave, Chicago, Ill.**

Baking Varnish E117

THIS ALL-PURPOSE BAKELITE-BASE insulating varnish is for use on all coils. One advantage of *Synthite AJR-7* is its ability to cure rapidly and completely at lower than average temperatures. This varnish is especially adapted for service on modern magnet wire, such as *Formvar*, *Formex*, nylon and glass. *Synthite AJR-7* provides a heavy build-up and can be applied by atmospheric dip or vacuum impregnation. It produces excellent results whether baked under infrared

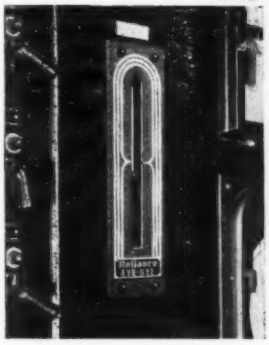
Fool-proof remote water level reading for any boiler or tank . . .

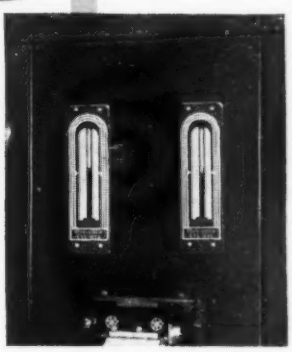


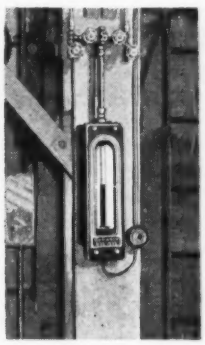
Reliance EYE-HYE assures you perfect measurement, dependability and clear reading—essentials for efficient operation and accident prevention . . .

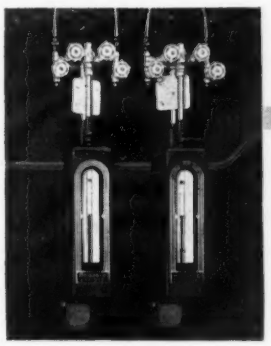
EYE-HYEs showing correct, unmistakable indication of your various water levels give you greater assurance that your plant can avoid expensive accidents and delays caused by water level failures. There's less resistence by operators to making frequent observations because EYE-HYE can be placed at eye-level, at convenient locations where it *can't be missed.* And its message can't be misunderstood.

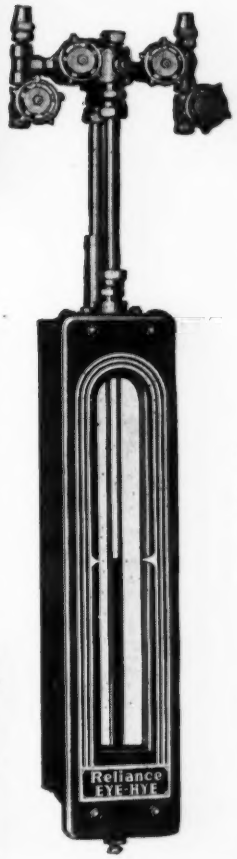
No matter what your working pressure or water level variation, EYE-HYE solves your remote reading problems for boilers, heaters, surge tanks or other vessels.











These sound principles of EYE-HYE design and operation are proved in nearly 8,000 installations:

1) Hydrostatic operation, eliminates all mechanical working parts; **2) One indicating fluid,** green color (heavier than water) will not mix or react with water or any water treatment compound; **3) Factory calibration** for positive accuracy of the water level range at the working steam pressure you specify. Nothing to adjust during installation; **4) Perfect vision** (integral illumination) in 12 inch length window; **5) Indicating fluid** rises and falls in similar fashion to, and in direct proportion to conventional boiler drum gage for easy double check; **6) Can be located** anywhere convenient . . . on panel board or wall, below or above the drum and any reasonable distance away.

Write the factory, or ask your nearest Reliance Representative for full information on the EYE-HYE.

BOILER SAFETY DEVICES since 1884

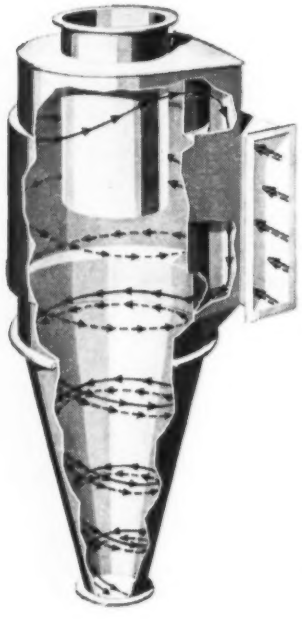
Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

PLANNING
EFFECTIVE
Fly-ash
Collection

Pinning one's faith to a proposed dust collection system is no casual matter. You want to be as sure of the engineering as you are of the equipment itself...Buell has a wealth of experience to lay on the line, and 100% of it in this specialized field. Fundamental, too, is the fact that each and every Buell installation is engineered and built for the special conditions under which it is to operate. Therein lies the secret of high-efficiency performance — and of greatest value per dollar of cost. To know Buell better, you ought to read the 32 pages of frank discussion in our new catalog.

Write. Buell Engineering Co., 10 Cedar St., New York 5, N. Y.



buell

Engineered Efficiency in DUST COLLECTION

or in the conventional gas or electric oven. It has a high degree of dip-tank stability, is easily handled in production and repair-shop treating cycles. **Dept 30, John C. Dolph Co, 1060 Broad St, Newark 2, N. J.**

Engine-Driven Welder E118

NEW FLEXARC LIGHTWEIGHT engine-driven welder, designated *The Ranger*, is designed for 200 amp at 30 v. It comes complete, ready to weld, including work and electrode leads, helmet, electrode holder, a liberal supply of electrodes, and a wire scratch brush. Dc generator is direct-connected to a Hercules *IXB* engine. Welding current can be adjusted from 30 amp at 20 v to 250 amp at 30 v in four major steps, by plugging-screw locking plugs on work and electrode leads. Intermediate values are obtained by rheostat control. Available either in a portable or stationary model. **Westinghouse Electric Corp, P O Box 868, Pittsburgh 30, Pa.**

Intake Cleaner E119

NEW SERIES ICS cleaner-silencer for the intakes of internal combustion engines, compressors and blowers. Available in pipe sizes from ¾ to 6 in. in diameter. Nonferrous filter element is quickly removable for cleaning or replacement. **Burgess-Manning Co, 749 E Park Ave, Libertyville, Ill.**

Fire Extinguisher E120

CARBON-DIOXIDE fire extinguisher, 15 in. long by 1⅞ in. dia, comes equipped with a wall bracket for mounting besides machines, equipment or materials. Weight is 2 lb, 6 oz filled. **Power-Pak Products, Inc, Buffalo 2, N. Y.**

Diaphragm Valve E121

HILLS-MCCANNA SAUNDERS PATENT VALVE is now available in corrosion-resisting alloys. The *Duriron* is particularly resistant to sulphuric, nitric and acetic acids. *Durichlor* is recommended for all concentra-

INCLUDE the

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEM

IN TODAY'S PLANS FOR COST SAVINGS . . .

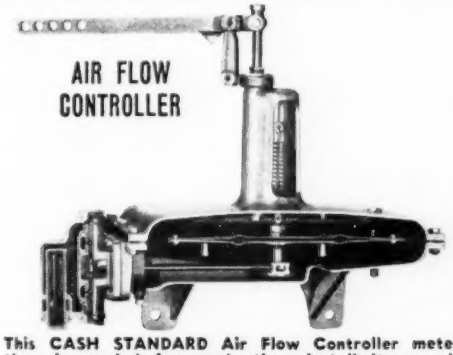
Look to your boiler room now as you inspect your complete operations for ways and means of combating high costs.

Your boiler room can be made to do an important job in saving money when a CASH STANDARD Automatic Combustion Control System is installed. Whether you have a single boiler or battery of boilers you can get the desired economy results. The reason is you constantly maintain the correct fuel feed—the correct fuel-air ratio and constant over-fire draft.

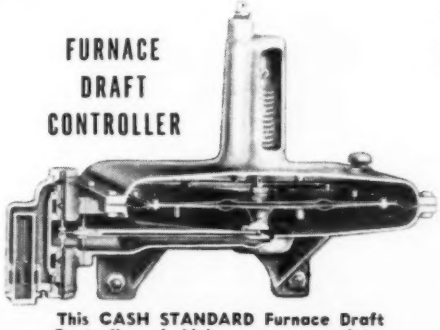
Booklet No. 300

Tells about the three requirements for cost saving Combustion Control and how the CASH STANDARD System effectively and continuously does the job.

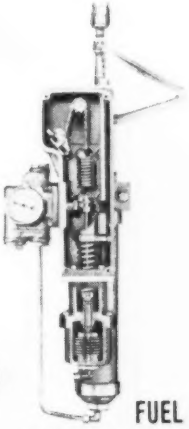
It shows applications of the CASH STANDARD Systems—if you burn coal, oil, or gas. It tells how combinations of the various CASH STANDARD units can be made to meet any specific condition and work on any boiler or stoker with any kind of fuel.



This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.



This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.



FUEL FEED CONTROLLER

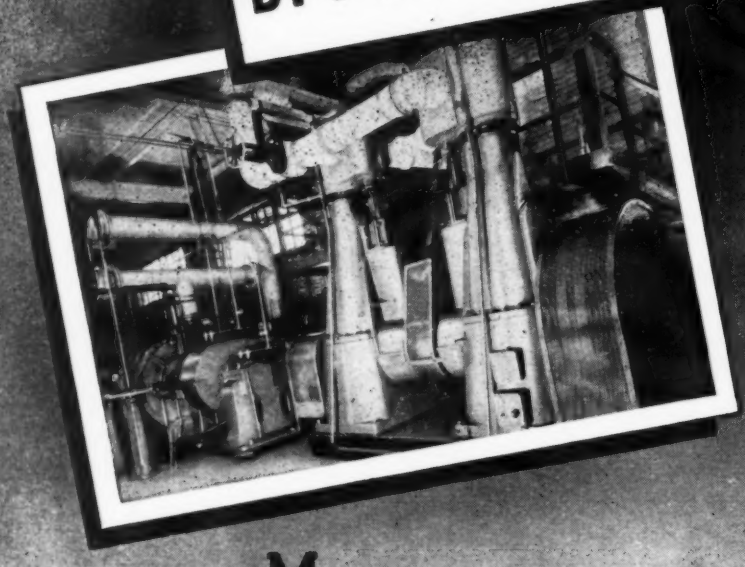
This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion—hence, money saving.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS . . VALVES

TROY-ENGBERG STEAM ENGINE

SAVE
BY USING
BY-PRODUCT POWER



Make your STEAM do two big jobs . . . eventually one of them at little or no cost. With proper heat balance your steam can provide—FIRST, power for driving equipment, and SECOND, heat units needed for processing or heating.

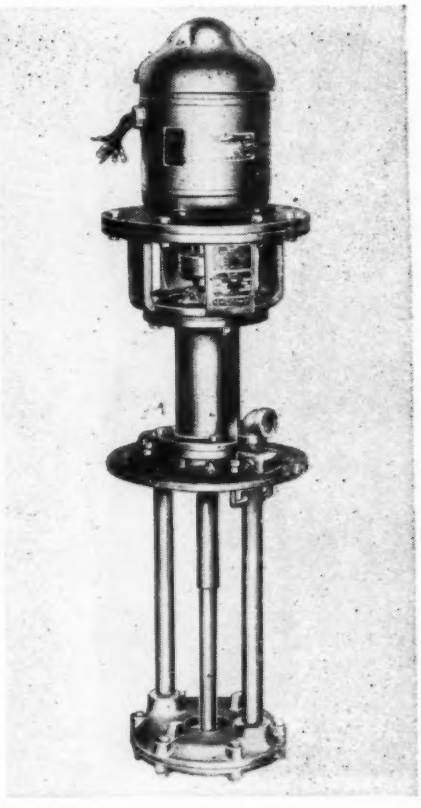
Use boiler steam to run a Troy-Engberg Steam Engine. THEN use the exhaust in your heating or processing lines. Drive your pumps, stokers, generators, blowers or compressors with By-Product Power. Use a Troy-Engberg Steam Engine as a reducing valve and your power cost saving will pay for the engine in a very short time.

Send for Bulletin 306

TROY ENGINE & MACHINE COMPANY
Established 1870
2500 Railroad Avenue Troy, Pennsylvania

TROY-ENGBERG
STEAM ENGINES • GENERATING SETS • GENERATORS

tions of hydrochloric acid at temperatures below boiling point. A tough, resilient, reinforced molded diaphragm, available in many types of rubber and synthetic rubber, separates body and operating mechanism. There is no stuffing box or stem packing; the diaphragm completely isolates bonnet parts from fluids passing through body. **Duriron Co, Dayton 1, Ohio.**



Overhead Bearing Pump E122

WET-PIT PUMP built without submerged bearings for handling abrasive and corrosive liquids. Pedestal attached to floor plate supports antifriction bearings on pump shaft. Machined end caps, clamped into the pedestal by two accessible bearing studs, support the bearings. Pump can be belt or motor driven. Suited for handling heavy liquids, hot liquids up to 1000 F, and liquids containing solids. **Nagle Pumps, Chicago Heights, Ill.**

Magnetic Pulley E123

NEW PERMANENT MAGNETIC PULLEY with *Alnico* poles is available in 53 sizes, from 12-in. diameter and 12-in. width to 30-in. diameter and 60-in. width. Used as a head pulley in belt conveyors it removes magnetic substances from nonmagnetic materials carried on the belt. Of permanent magnet construction, no electrical wiring is required. Magnetic permanence is guaranteed forever if the magnets are used properly.

A crowned face prevents belt weaving on the pulley and helps distribute load across belt as it passes over pulley. Standard shaft diameters permit replacement of nonmagnetic head pulleys in existing installa-

Piping News EXTRA 1947

LADISH ANNOUNCES AN IMPORTANT NEW DEVELOPMENT

A SEAMLESS REDUCING ELBOW

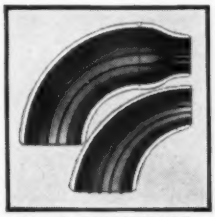
Now from Ladish metallurgical and engineering laboratories comes another significant advancement . . . *the first practical seamless reducing elbow to be forged in one piece.* Featuring maximum physical properties and geometric accuracy, this new development provides improvement in the flow efficiency of piping systems and offers material savings in erection costs.

Now a single Ladish Reducing Elbow replaces the 90° Elbow and Reducer formerly required to change the direction of flow and reduce the pipe size simultaneously . . . AND . . . it eliminates one weld and a reducing fitting. Since the reduction in diameter is gradual and uniform from face to face, piping systems installed with Ladish Reducing Elbows benefit from the smooth, uninterrupted flow that helps maintain maximum pressure.

In addition to the flow advantages of seamless design, Ladish Reducing Elbows provide a fine, compact metal structure of high dynamic strength and toughness. For full information regarding range of sizes, prices and delivery, contact your nearby Ladish Distributor, District Office or write direct.

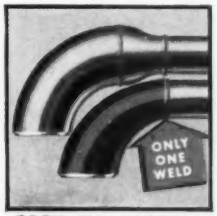
SEAMLESS DESIGN

Ladish Seamless Reducing Elbows are formed from highest quality seamless tubing at forging temperatures by a process that scientifically distributes metal uniformly throughout the walls of the fitting for maximum strength and safety.



FLOW EFFICIENCY

Uniform, gradual reduction of diameter from face to face of the fitting ...without abrupt change of diameter to impede flow...and full effective center line radius help maintain pressures and provide maximum flow efficiency.



EASY TO INSTALL

Ladish Reducing Elbows save time and simplify installation by eliminating the extra weld necessary when separate elbow and reducer are used. The smooth, unbroken exterior also helps simplify application of insulation when required.

Controlled Quality
FITTINGS

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

DISTRICT OFFICES:
New York • Buffalo • Pittsburgh • Cleveland • Chicago • St. Louis • Atlanta • Houston • Los Angeles

Below are typical CMH Free-Flexing and Controlled-Flexing Expansion Joints . . . Engineered for simple, practical control of expansion, vibration aud misalignment in your pipe lines

CMH EXPANSION JOINTS . . .

the practical way

to ENGINEERED EXPANSION and VIBRATION CONTROL

Practical operating engineers need practical answers to expansion and vibration control problems in pipe lines — And CMH Expansion Joints provide those answers.

Compact, dependable, and adaptable for original installations, and for replacement of all types of obsolete expansion joints, CMH Free-Flexing and Controlled-Flexing Joints perfectly fit the needs of most plant piping layouts, new and old.

CMH Expansion Joints are copper or stainless steel, packless, bellows-type units, requiring no maintenance or other attention. Sizes range from 4" to 24" inside diameters, with flanged or welding ends to suit connected piping requirements. Conservatively rated for pressures up to 300 p.s.i., and temperatures to 900° F.

CMH-engineered curvature of corrugations distributes expansion loads throughout the pressure carrier to provide maximum fatigue resistance with its accompanying longer service life. Controlled-Flexing units have control rings designed to fit corrugation curvatures within close tolerances to effect positive protection against deformation under high pressures and temperatures.

CMH Bulletin EJ-47 gives technical data on all CMH Expansion Joints . . . For practical solutions of your pipe expansion, vibration and misalignment problems, write for your copy today. Personal engineering assistance will be given as required, without obligation.

*the science of **FLEXONICS** . . . "the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion" . . . is exemplified in the basic products of Chicago Metal Hose Corporation.

"FLEXON" identifies CMH products, which have served industry for more than 45 years.

CMH

CHICAGO METAL HOSE CORPORATION

Expansion Joint Division
Maywood, Illinois
Plants at Maywood and Elgin, Illinois

METALLIC AND FIBROUS PACKINGS FOR EVERY PURPOSE

THE ANCHOR PACKING CO. TRADE MARK

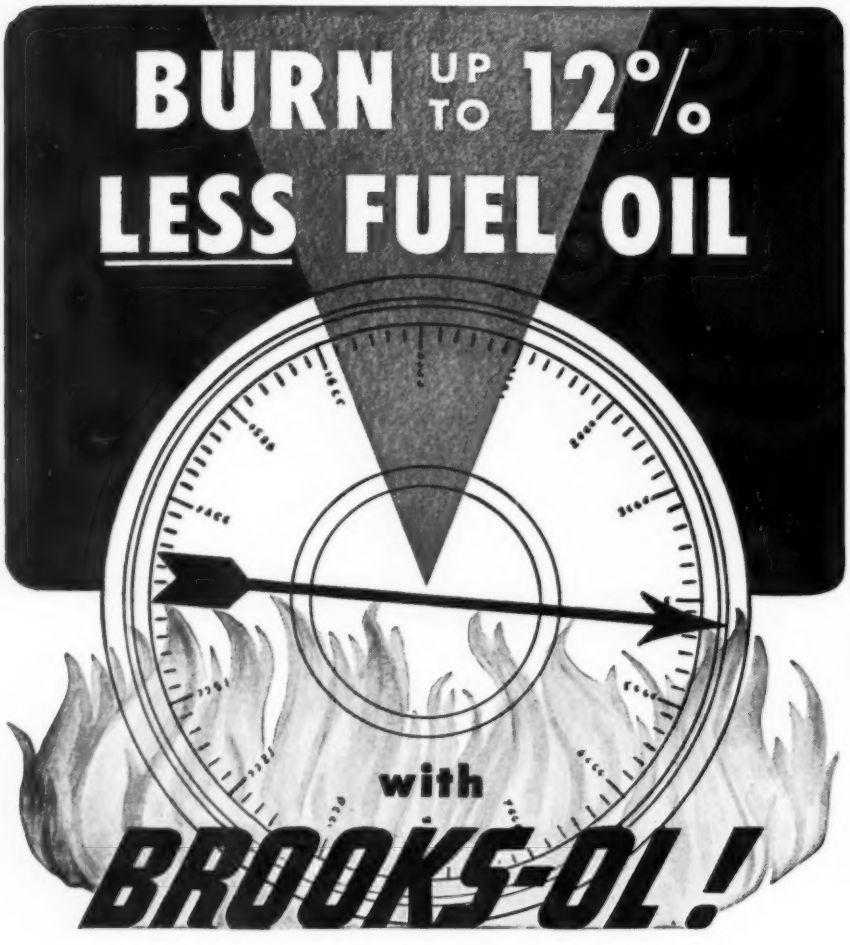
THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

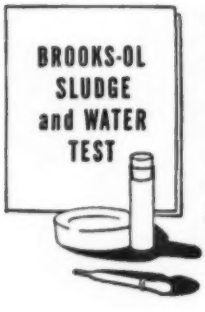
BRANCH OFFICES

Gay and Lombard Streets . . . . . Baltimore 2, Maryland
150 Causeway Street . . . . . Boston 14, Massachusetts
Andrews Building . . . . . Buffalo 2, New York
Rockefeller Building . . . . . Cleveland 13, Ohio
900 South Wabash Avenue . . . . . Chicago 5, Illinois
4 West 7th Street . . . . . Cincinnati 2, Ohio
642 Beaubien Street . . . . . Detroit 26, Michigan
509 Washington Avenue . . . . . Houston 2, Texas
720 Mateo Street . . . . . Los Angeles 21, California
5575 Cote St. Paul Road . . . . . Montreal 20, Canada
418 Common Street . . . . . New Orleans 4, Louisiana
100 6th Avenue . . . . . New York 13, New York
401 North Broad Street . . . . Philadelphia 8, Pennsylvania
405 Penn Avenue . . . . . Pittsburgh 22, Pennsylvania
Terminal Sales Building . . . . . Portland 1, Oregon
156 South Park . . . . . San Francisco 7, California
2207 1st Avenue South . . . . . Seattle 4, Washington
1407 Pine Street . . . . . St. Louis 3, Missouri
921 South Richmond Street . . . . . Tulsa, Oklahoma
524 Avalon Boulevard . . . . . Wilmington, California



New kind of fuel oil additive *ends sludge,* too!

BROOKS-OL, the *new* chemical fuel oil additive, eliminates sludge by reducing fuel oil viscosity, breaking up emulsions and separating excessive amounts of water from oil. Increased liberation of B. T. U.'s per pound of oil thus lowers consumption by as much as 8% to 12%! Used by leading industrial firms throughout the country.



SEND FOR BROOKS-OL TEST KIT!

Make this test yourself! Give the BROOKS-OL Sludge and Water Test to sludge *from your own fuel oil tank.* It takes only a few minutes. Before your eyes, BROOKS-OL dissolves sludge, breaks up emulsions—*fast!* We'll send you a kit along with complete instructions. Just request the BROOKS-OL Test Kit on your own company stationery. No obligation. Write today . . . save fuel and you save money!

SINCE B 1876

THE BROOKS BOILER TREATMENT COMPANY

3304 East 87th Street, Cleveland 4, Ohio

BOILER METAL TREATMENT • WATER TREATMENT • ZEOLITE SOFTENER TREATMENT • BRINE TREATMENT • WATER CONDITIONER • CONDENSER AND COOLING WATER TREATMENT FURNACE SOOT AND CARBON REMOVER • BOILER RUST AND CORROSION REMOVER • ASBESTOS ROOF COATING

tions without changing bearings or shaft mountings. Pulley head plates are nonmagnetic to prevent magnetic material collecting on the outside edges. **Dings Magnetic Separator Co, Milwaukee, Wis.**

Boiler Fittings E124

No. 160 WATER GAGE and No. 196 gagecocks are available in ⅜-, ½- and ¾-in. iron-pipe-thread sizes. The gages have self-cleaning stems and are complete with packing and any length gage glass and guards. Cocks are shipped complete with packed stuffing box; the soft metal seat is a special alloy that gives positive, long-life shutoff and will not squeeze out in service. **Swift Lubricator Co, Elmira, N. Y.**

Power Jack Tractor E125

JACK TRACTOR speeds up warehouse operations and increases amount of usable storage space. It is built to tow trailer trains and to serve as a pushing unit. Has 500-lb draw-bar pull. Vertical handle operation allows any or all controls to operate in any position. Electric brake applies instantly when handle triggers are released. Master drive unit may be replaced in 20 min. Powered by storage battery that provides for 8- to 10-hr work period with maximum load. **Lewis-Shepard Products, 297 Walnut St, Watertown 72, Mass.**

Temperature Control E126

NEW HOT-WATER immersion-type temperature-control unit has cadmium-plated frame and a bonderized cover to prevent corrosion. Electrical contacts are available for 110 v, 10 amp; or 220 v, 5 amp. Differential is fixed at 10 F. **Thermix Corp, Greenwich, Conn.**

Brazing Flux E127

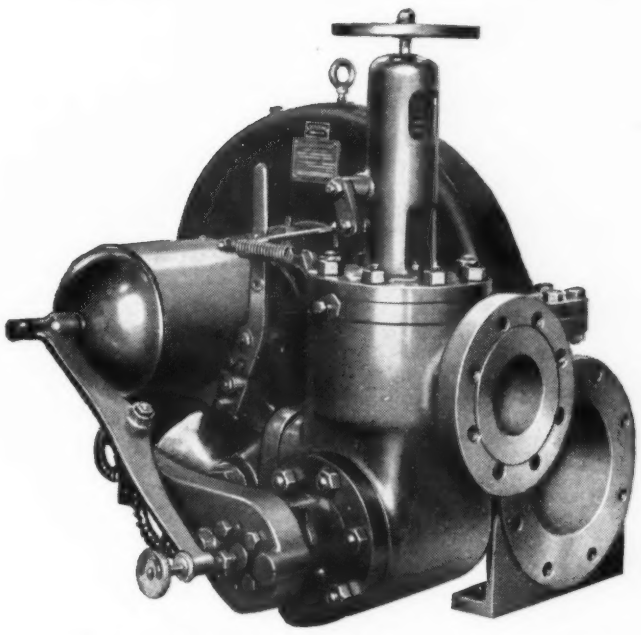
NEW ALL-STATE No. 39 FLUX is suitable for joining aluminum with dissimilar ferrous and nonferrous metals at low working temperatures. Used in conjunction with All-State No. 39 aluminum solder, the flux makes the solder flow rapidly over the work. Available in thin paste form in 1-lb, ½-lb and ¼-lb jars. **All-State Welding Alloys Co, 96 W Post Road, White Plains, N. Y.**

Screw Anchors E128

THIS NEW PLASTIC ANCHOR simplifies installation, reduces cost, and gives greater holding power. An exclusive feature is the overlapping internal and external slits. These give "concertina" expansion, which is necessary in an anchor for dependable holding in all materials. This feature develops a tremendous holding power, far greater than ordinary needs demand. Some outstanding features of this anchor are: (1) It can be used in any material. (2) It resists moisture, weather and acid. It is immune to age and corrosion, and will not decay. Made of tough material

NOW! QUICK DELIVERY

On Small TURBINE DRIVES*



*STANDARD (single-stage, shaft-governed) mechanical-drive turbines.

If you're up against a shortage of horsepower, here's good news—We're making deliveries on standard mechanical-drive turbines in ***12 weeks or less.*** The turbines are really rolling out of our new Fitchburg plant these days, thanks to standardization. The standard line (shaft-governed, single-stage turbines) ranges from 10 to 800 hp.

MANY APPLICATIONS

G-E standard turbines are ready to go to work in any plant where steam is used. They can do a multitude of jobs—driving pumps, compressors, fans, blowers, line shafts, processing machines. If you use process steam, these turbines can reduce high-pressure steam to your process pressure, at the same time producing low-cost driving power.

QUICK SERVICE

You can get service in a hurry when you operate G-E turbine drive. You have twenty-six service shops and 115 sales offices located throughout the country, to call on for quick and convenient aid.

GET YOUR HORSEPOWER NOW

If your plant needs more horsepower, and you have steam available, why not put economical G-E turbines to work? The turbine specialist in your local G-E office will be glad to assist you in the application of turbine drive. And—he's in position to give you fast shipment on standard designs. Call him today! *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

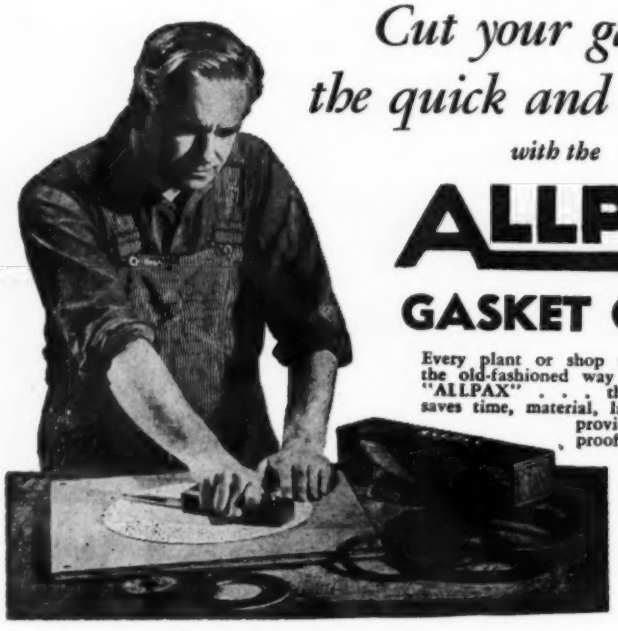
252-21

Cut your gaskets the quick and easy way

with the

ALLPAX

GASKET CUTTER



Every plant or shop now cutting gaskets the old-fashioned way by hand, needs an "ALLPAX" . . . the gasket cutter that saves time, material, labor and money. It provides a simple, foolproof method of cutting which can be done by anyone. Saves its cost in the first few gaskets cut. Cuts clean, accurate gaskets in any packing material from 1" to 36" diameter.

Furnished complete with six (6) double-edge cutting blades and one (1) 18" cutting board . . . all packed in durable hardwood case with hinged cover . . . ready for any gasket cutting job. Price $19.50 complete equipment, f.o.b. Mamaroneck, N. Y. ORDER NOW.

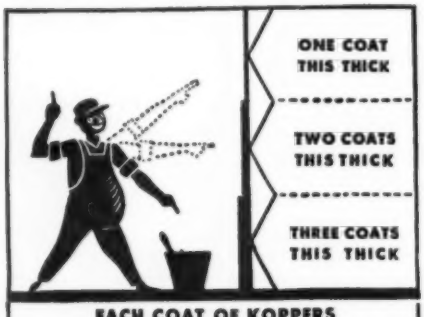
THE ALLPAX CO., INC.

Mamaroneck, N. Y.

BITUPLASTIC

REG. U S PAT. OFF.

A KOPPERS PROTECTIVE COATING



EACH COAT OF KOPPERS

BITUPLASTIC

REG. U S PAT. OFF.

EQUALS 5 COATS OF PAINT

Bituplastic is *not paint*

IT IS...

- ✓ a highly refined, easily workable coal tar base coating
- ✓ applied cold with brush or standard spray
- ✓ a complete vapor seal
- ✓ fire retardant
- ✓ impervious to temperatures of −50° F to +500° F
- ✓ applicable to damp surfaces
- ✓ virtually odorless and tasteless
- ✓ quick drying (usually a matter of minutes)

USE BITUPLASTIC* FOR VAPOR SEALING SURFACES EXPOSED TO CORROSION...

THE BASE IS TOUGH... a time proved seal against corrosion . . . refined coal tar—as a stable dispersion in water—forms a thick plastic coating for the protection of metal, concrete or masonry surfaces.

AND THE COAT IS THICK... Bituplastic covers heavily; 1/64" to a coat, or about 5 times the thickness of ordinary paint. Successive applications can provide a seamless, non-porous sheath up to 1/16" in thickness, completely resistant to most corrosive conditions.

*Reg. U. S. Pat. Off.

USE A BRUSH...OR STANDARD SPRAY

Suggestions for use, rate o coverage and other data are in a new Bulletin on Bituplastic. Ask your distributor or address...

KOPPERS COMPANY, INC.

WAILES DOVE-HERMISTON DEPARTMENT

WESTFIELD, NEW JERSEY

with high impact strength, it also has good electrical characteristics. It fits in a smaller hole than usual and is easily cut to any required length. **Holub Industries, Inc, Sycamore, Ill.**

Entraining Agent E129

GREATER SEALING RESISTANCE, longer flexural strength come from entraining about 3 to 5% of air in concrete, according to the claims of the *Ayr-Trap* manufacturer. The percentage of air in the form of tiny bubbles is held to the desired 3-5% by an entraining agent. *Ayr-Trap* comes in two forms (1) a liquid of which one pint is required for 5 cu yd of concrete, 6-bag mix (2) a powder, using one lb per cu yd of concrete, 6-bag mix. **A C Horn Co, Long Island City, N. Y.**

Waste-Heat Boiler E130

FULLY SELF-CONTAINED in an insulated steel cabinet, 6 ft, 6 in. long by 7 ft, 6 in. high and 3 ft, 2 in. wide, this waste-heat boiler operates from exhaust gas of a turbocharged diesel. Unit generates up to 500 lb per hr of steam using exhaust gas of 600 to 800 F. By cutting in an oil burner, the boiler continues to deliver steam after the diesel engine stops. It can also be run dry to act as a muffler for the diesel. **American Locomotive Co, 30 Church St, New York 8, N. Y.**

Ground Connector E131

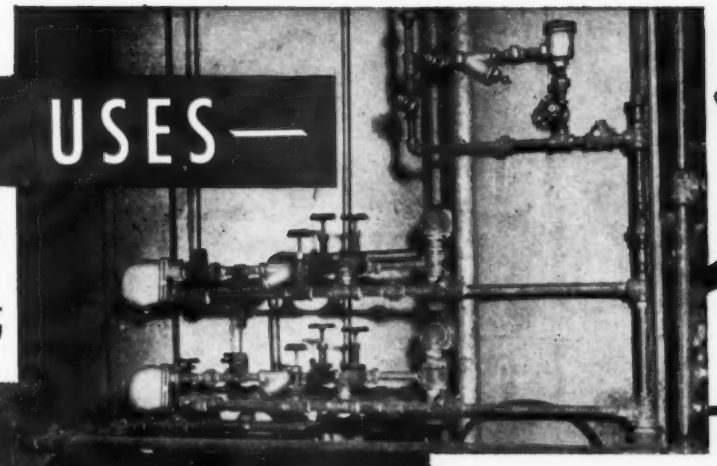
THE CROSS-GROOVE DESIGN of this new type *GAR* ground connector permits connecting ground bus either parallel or at right angles to driven rod or pipe. In both applications the type *GAR* can be easily slipped over driven rod even if the top has been mushroomed. Connection is made secure merely by tightening two nuts on the U-bolt. Current-carrying high-copper-alloy cast body with silicon bronze U-bolt nut and clock washer permits the entire connection to be varied in the ground without danger of corrosion.

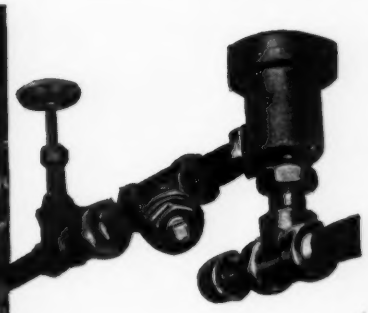
These units are supplied for all sizes from ½-in. rod to 6-in. iron pipe size and No. 8 solid conductor to 750 mcm ground conductor. **Burndy Engrg Co, 107 Bruckner Blvd, New York, N. Y.**

Servo System E132

AUTOMATIC IN OPERATION, this electronic remote-control positioning unit controls valves, dampers and other mechanical mechanisms. Basic units, which make up the complete system, can be combined in a variety of ways to produce systems to meet many industrial remote-control needs. These units consist of a transmitter, from which any desired position of a remote receiver can be selected. A control amplifier responds to the setting of the transmitter, and a receiver moves the load to any desired position. This servo system operates with the high accuracy of laboratory instruments, but is constructed for heavy-industry use. The strong dustproof cast-metal cases of the transmitter, amplifier

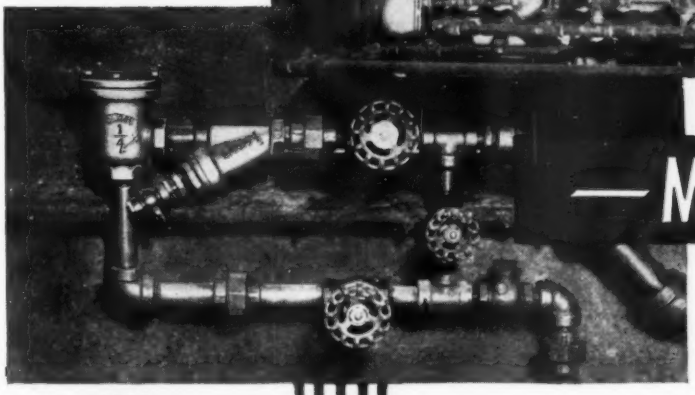
MANY USES—





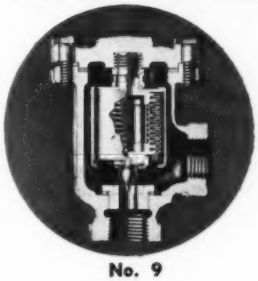
Float-thermostatic traps on rust-proofing compound tanks.

Sarco No. 9 with SB strainer on rust-proofing compound tanks.

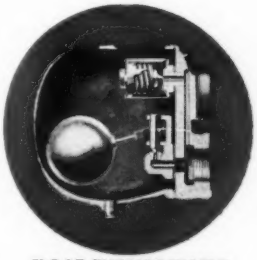


—MANY SAVINGS

IN THIS ALL-SARCO CHEMICAL PLANT



No. 9



FLOAT-THERMOSTATIC

SCRAPER STRAINER

Liquids must flow freely, process steam coils must be active and efficient and room temperatures are important in this mid-west chemical plant. The new Sarco No. 9 thermostatic steam trap is playing a vital part in securing these results. But even the No. 9 can't do everything. The view at the top shows three Sarco Float-Thermostatic traps operating at 100, 50 and 25 lbs. pressure on the series coils in the rust proofing compound tanks.

Sarco scraper strainers are used to insure the flow of liquids from these tanks. In other chemical and food plants in this same area you will find Sarco Bucket Traps, No. 87 trap-controls, H radiator traps and a dozen entirely different forms of Sarco mechanical and electrical temperature controls.

It's a one-stop shopping tour when you come to Sarco with your heating, cooling and process problems. It is unit responsibility at its best, with all units working smoothly together to save and serve. It all begins with one phone call to the nearest Sarco Representative.

149

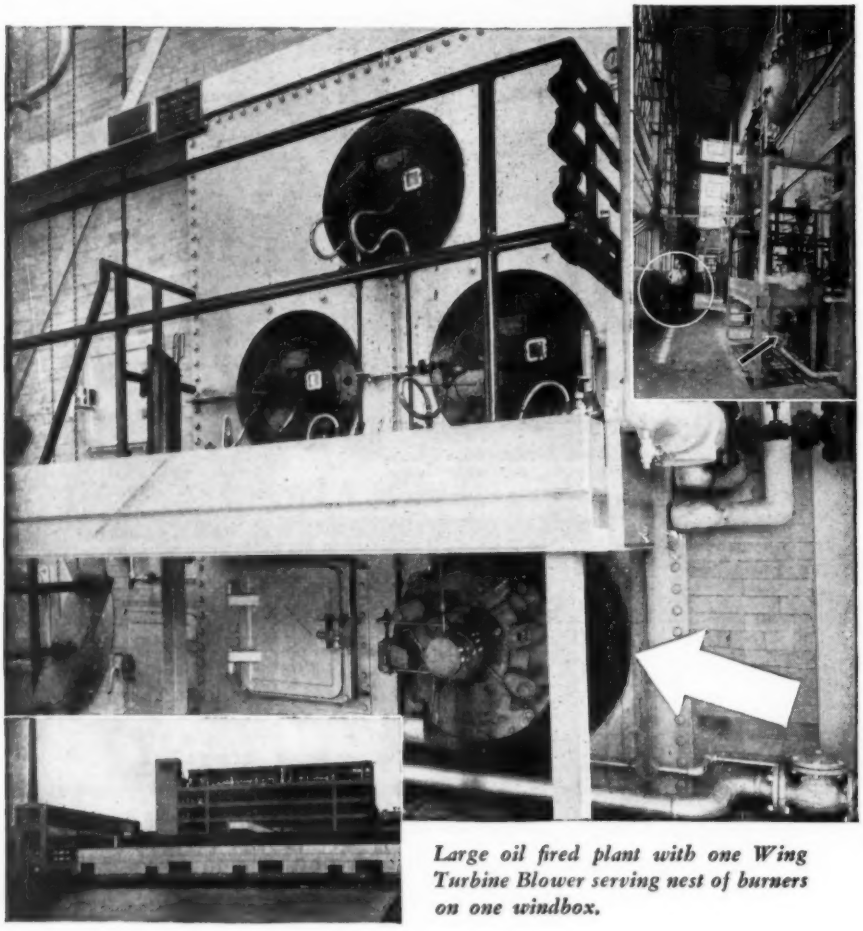
SARCO SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO



Large oil fired plant with one Wing Turbine Blower serving nest of burners on one windbox.

Wing Turbine Blowers Save:

POWER COSTS—because they can be installed on windboxes thereby eliminating duct losses requiring higher initial driving power.

ENGINEERING LAYOUT TIME AND EXPENSE—because there are no ducts to design and find space for with their cumbersomeness and expense.

MAINTENANCE—because of their utter simplicity. An occasional shot of lubricant to the two ball bearings plus a very infrequent take-up on packing glands is all that is required of routine handling. There is no more rugged machine in any power plant than a Wing Blower.

Write for Bulletin SW-1

L. J. Wing Mfg. Co. **50 Seventh Ave.,** **New York 11, N. Y.**

Factories in Newark, N. J. and Montreal, Canada

TURBINE BLOWERS • TURBINES • • FANS • MOTOR DRIVEN BLOWERS
REVOLVING UNIT HEATERS • UTILITY HEATERS • FIXED DISCHARGE UNIT HEATERS
DUCT FANS • DRAFT INDUCERS • HEATER SECTIONS • SHIP VENTILATORS • FOG ELIMINATORS

and receiver are built to withstand shock, vibration, corrosion and other tough industrial operating conditions. Four protected but readily accessible set-screws make adjustment easy. Bearing is located in a drop panel for ready inspection. The complete amplifier can be removed and replaced without use of tools. **Askania Regulator Co, 240 E Ontario St, Chicago 11, Ill.**

Shockproof Fuse E133

THIS RENEWABLE cartridge fuse is designed for shockproof service and rapid renewal. The knife-blade type has only two main parts: a cartridge case and a link blade assembly. When blowout occurs gases, heat and pressure are dissipated through a controlled vent passage. *Solar* fuses in ferrule type are equipped with renewable "timed-lag" links. Available in sizes from 3-600 amp, 250- or 600-v, they are approved by Underwriters Laboratories, Inc. **Solar Electric Corp, Warren, Pa.**

Packless Valves E134

DIAPHRAGM UNIT is a combined shutoff and check valve. Body, bonnet and hand-wheel are brass forgings. Comes in ½-in. size. Diaphragm eliminates the stuffing box and stem packing. **Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.**

Leather V-Belt E135

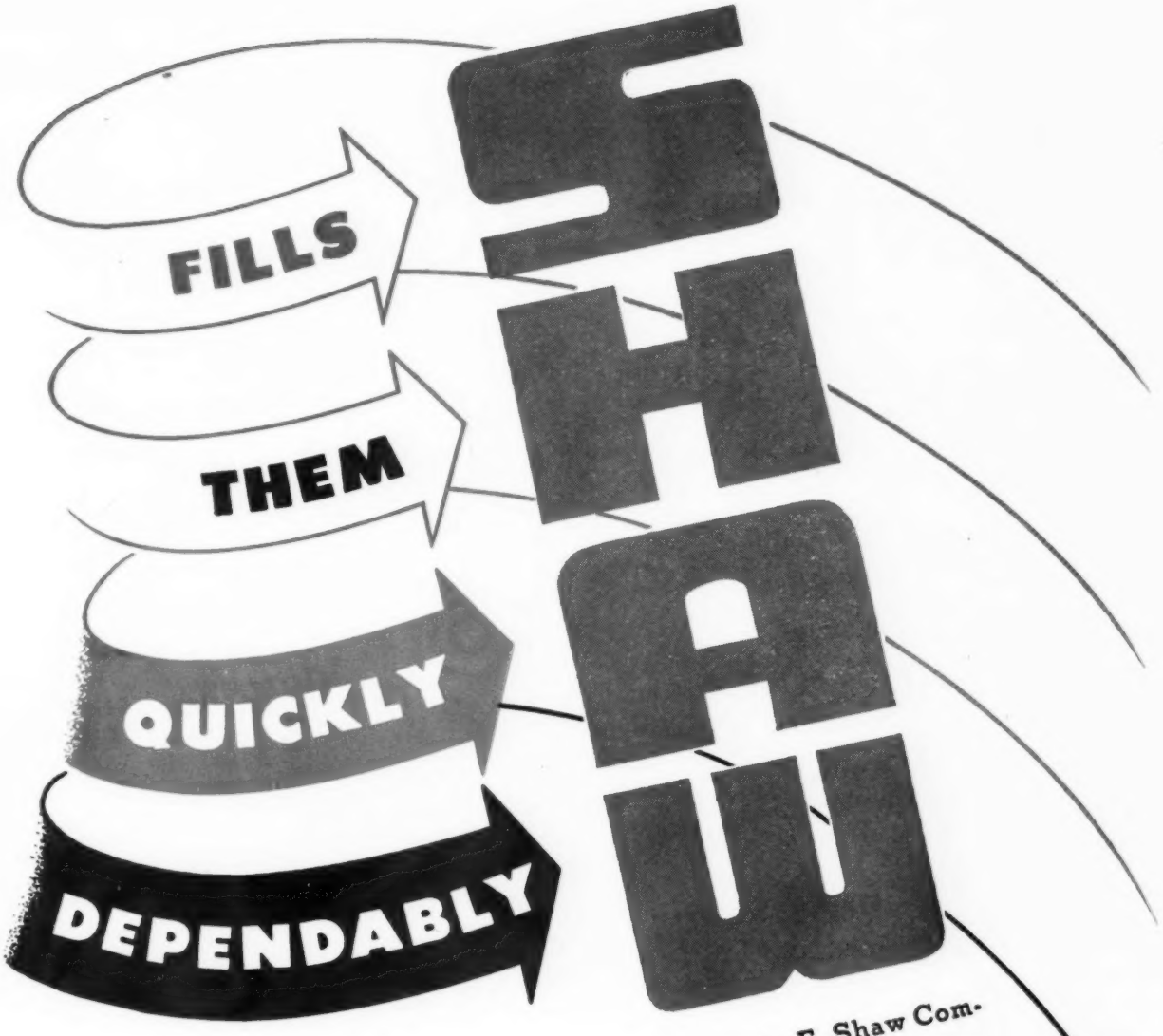
LEATHER V-BELT, which can be spliced to fit any drive centers, is supplied in 100-ft rolls. Both sidewalls are flat, full-grain leather. Belts can be made endless to fit any drive by either a lapped splice or mechanical fasteners. A lap press-and-tension device, also available, permits the belt to be installed endless under any desired tension directly on the drive. **C A Schieren Co, 30-38 Ferry St, New York, N. Y.**

Temperature Recorder E136

MINIATURE-SIZE temperature recorder is designed for use where a shock-resistant easily portable instrument is needed. Available in two forms: the single-pen recording thermometer for recording temperature only, and the 2-pen instrument for temperature and time operation to chart the running time of refrigeration machines. Chart drive is a 7-day spring-propelled mechanism with charts of 24- or 72-hr duration. Each recorder is inclosed in an aluminum case with smooth, black-enamel finish. Total weight is less than 3½ lb. **C J Tagliabue Mfg Co, Brooklyn 5, New York.**

Fairbanks, Alaska, has applied to the Federal Works Agency for funds to finance the planning of a $3,500,000 public utilities system. It will include an electric power and heating plant with corresponding distribution lines, a telephone and water system. Mayor A H Nordale says the city plans to acquire the present utilities and expand them.

Whatever Your Piping Needs



Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping —any place in the United States and Canada.

President

Known since 1893 for High-quality

Dependable PIPING Pre-fabrication & Installation

BENJAMIN F. SHAW COMPANY—2ND & LOMBARD STS., WILMINGTON, DEL.

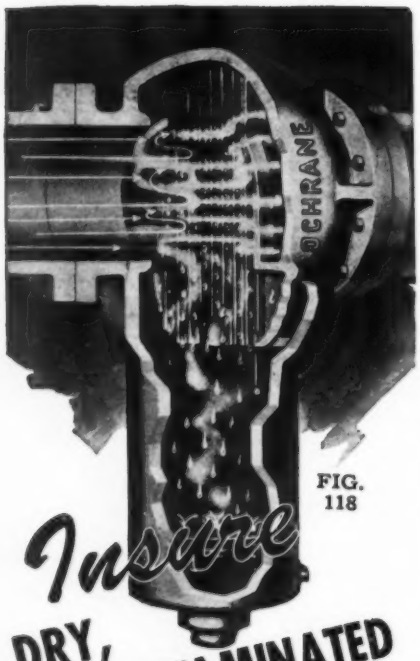


FIG. 118

Insure

DRY, UNCONTAMINATED STEAM with

COCHRANE

SINCE 1863

ALL-SERVICE SEPARATORS

Where the flow of steam is horizontal, the Fig. 118 Cochrane All-Service Separator is used for the elimination of moisture or oil. Cochrane Separators are the most widely used and most successful type of separator. At least 50,000 are in daily use, removing oil or moisture from steam or air. The separator has exceptional port area, is self-cleaning, one-piece construction. The condensate chamber is of large capacity and the baffle is so designed that the purified steam or air does not come in contact again with the entrainment.

Write for Publication 2950.

COCHRANE CORPORATION
3106 North 17th St., Phila. 32, Pa.

COCHRANE STEAM SPECIALTIES

Power News

(*Continued from page* 142)

Boiler Code Committee of American Society of Mechanical Engineers has announced that its special committee to revise Section VIII of the *ASME Boiler Construction Code* has prepared and submitted in draft form the proposed revision of Section VIII of the Code (*Unfired Pressure Vessel Code*) dated Jan 1947. Public hearings were held in May at Houston, Texas and Los Angeles, Calif., where some 250 representatives exchanged views on the proposed revision. Boiler Code Committee will hold another public hearing on the proposed revision of Section VIII in the Engrg Societies Bldg, 29 W 39th St, New York, N. Y., on Nov. 19, 1947, at 10:00 am. The purpose of this hearing is to give all those interested in the proposed revision an opportunity to express their comments verbally. Boiler Code Committee is particularly desirous of attracting to this meeting all users of the *ASME Unfired Pressure Vessel Code.*

Those desiring to review the proposed revision may obtain copies from the ASME at 29 W 39th St, New York 18, N. Y., at $1 each. All those interested are also invited to submit their written comments to the secretary of the Boiler Code Committee.

Clinton Laboratories at Oak Ridge, Tenn., first government-built nuclear research center and principal production plant for radioisotopes, will be renamed Clinton National Laboratory to become the third in the Atomic Energy Commission's national laboratories. Fourteen Southern universities in the Oak Ridge Institute for Nuclear Studies and a score of industries and industrial representatives will participate in the research, development and training programs at Clinton National Laboratory. Operation of Clinton National Laboratory will be taken over by University of Chicago. Negotiations for a 4-year contract now under way are expected to permit the university to complete by Dec 31 the transfer from Monsanto Chemical Co, which has managed the Clinton research facility since July 1945.

U. S. Atomic Energy Commission has received the first report of its Patent Advisory Panel, appointed in Jan, 1947, to recommend policy, procedures and staff organization implementing the patent provisions of the Atomic Energy Act of 1946. The Patent Advisory Panel concluded that the impact of patent provisions of the Atomic Energy Act is as small as is consistent with needs of common defense and security, that normal incentives of the patent system are left open except for certain patents specifically bearing on atomic energy development, and that Atomic Energy Commission is pursuing a policy of avoiding unnecessary interference with normal functioning of the patent system. Full text of the report may be obtained at the *Atomic Energy Commission, 19th and Constitution, EX* 1616, *Brs* 307, 308, *Washington* 25, *D. C.*

BENEFITS for power plant engineers

71 Practical Ways to Streamline Maintenance Cleaning in Power Plants

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NO wonder hundreds of maintenance engineers have found money-saving benefits in the comprehensive Oakite Power Plant Digest!

To prepare this helpful manual we culled a mass of reports covering the use of Oakite materials and techniques in steam generating, electric power and light plants. We keyed 71 top-priority cleaning, descaling and related jobs. We described in detail the most successful Oakite procedure for each job.

Get a copy yourself and see how money and time may be saved, power output increased, and equipment life prolonged by means of the scientific application of specialized Oakite materials.

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Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

Edge Moor Radiant Heat Boiler equipped with Edge Moor vertical tube integral economizer. Fired with continuous discharge spreader stoker. 150,000 lbs. steam per hour, 500 lbs. pressure, 750° F. total steam temperature.

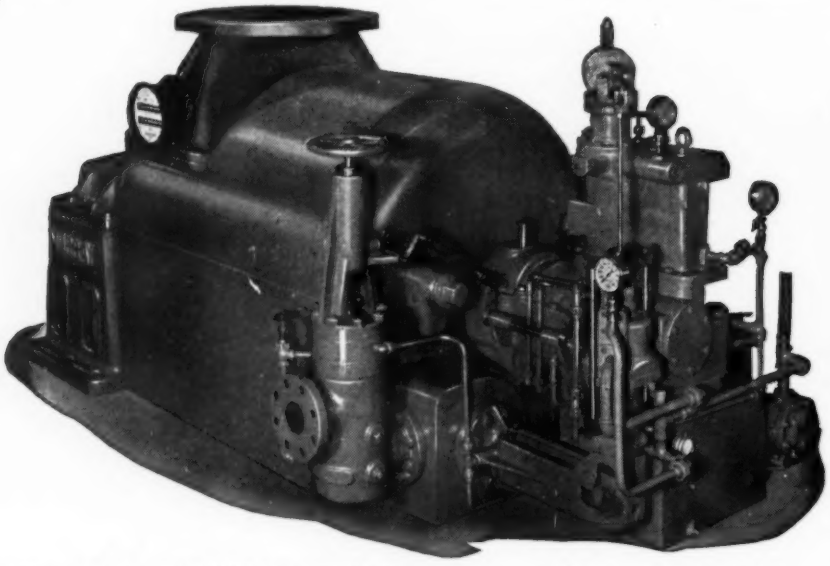
BOILERS *by* edge moor

THE dependability, efficiency and flexibility of this unit has been made possible by 80 years of Edge Moor designing and engineering skill. Its design provides for a large water storage, generous steam liberation surface and quiet offtake drum. Maximum boiler tube surface is exposed to radiant heat and furnace cooling is arranged for a minimum of maintenance. This quick-steaming unit delivers continuous high ratings over many years and is adaptable to all fuels.

This and other types of Edge Moor boilers are available in a wide range of capacities, pressures and accessory equipment. Write for literature today. EDGE MOOR IRON WORKS, INC. Main Office and Works: Edge Moor, Delaware. Branch Offices and Agents: Atlanta, Boston, Chicago, Detroit, Hoboken, St. Paul, San Antonio and San Francisco.

edge moor steam generating equipment

EM



One of two MURRAY multistage steam turbines, designed to deliver 685 horsepower on steam at 110 pounds and exhausting to 26½ inches Hg vacuum, furnished to drive high speed centrifugal compressors for refrigeration in one of the most prominent Southern Hotels. A third unit has recently been shipped. Equipment includes variable speed oil relay, governor, trip and throttle valve, strainer surrounding the double seated balanced governor valve, and force feed lubrication.

MURRAY
MULTISTAGE
STEAM TURBINES

★ ★ ★ ★

The complete MURRAY line of steam turbines includes all variations of mechanical drives, and turbine generator sets up to and including 3000 KW rating.

Sales Representatives for Murray products are located in all principal cities.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of steam Power Equipment for Three Quarters of a Century

James F Lincoln Arc Welding Foundation has announced the rules of its annual engineering undergraduate award and scholarship program. This program contains two interdependent plans: award and scholarship. Under the award plan, engineering students of various engineering schools and colleges will submit papers on arc-welded design and the use of welding in maintenance of machines and structures. Under the scholarship plan, scholarships will be allocated to the schools in which the three highest award recipients under the award program are registered.

Awards for papers will be as follows: one award for $1000, one for $500, one for $250, four awards of $150 each, eight of $100 each, 12 of $50 each and 50 of $25 each.

Copy of the rules and conditions may be obtained by writing *James F Lincoln Arc Welding Foundation, Cleveland 1, Ohio.* Papers must be postmarked not later than midnight, May 15, 1948, and awards will be announced as soon thereafter as is practical.

El Paso Natural Gas Co of El Paso, Texas, has filed with Federal Power Commission an application for a certificate of public convenience and necessity authorizing construction and operation of a $55,395,340 project designed to make available to California an additional 200,000,000 cu ft of natural gas per day. It is intended to begin construction of the proposed facilities in 1951 and to complete them so gas from San Juan County will be delivered to California about Jan. 1, 1952. The construction schedule plans delivery from Lea County to Blythe beginning in 1952 or 1953 as demands for natural gas in California may require.

Dr John T Rettaliata, head of mechanical engineering dept at Illinois Institute of Technology in Chicago, forecasts an early end for the high-powered aviation piston engine, both for military and commercial use. In an address before the Mexico City section of American Institute of Electrical Engineers, Rettaliata predicted that the gas turbine will be well entrenched within five years in the high-speed large commercial transport field and within ten years its supplanting of piston engines for this use should be essentially complete.

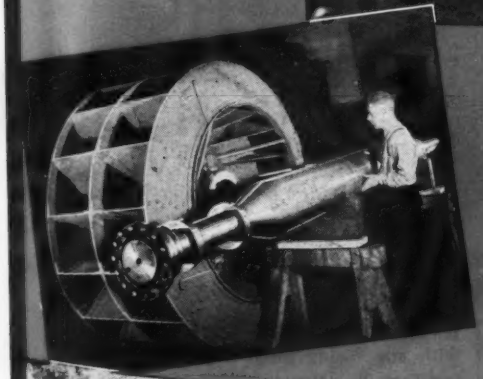
Public Service Co of Illinois has placed in service near Kankakee, Ill., a pilot installation using pressure vessels fabricated from lengths of seamless steel pipe for storing 1,250,000 cu ft of natural gas at 2240 psi. It is intended to supplement low-pressure distribution in the Kankakee area and provide an emergency supply for high-pressure customers in the area normally supplied from the high-pressure distribution feeder main from Mattison, Ill. Another unit capable of storing 40,000,000 cu ft is now in process of construction at Evanston, Ill.

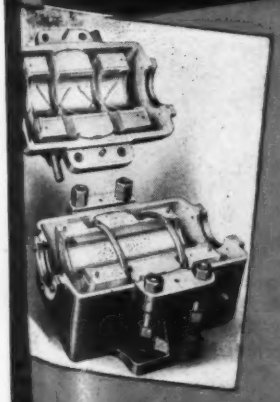
Chicago Metal Hose Corp of Maywood and Elgin, Ill., has announced purchase of all the capital stock of Fort Dearborn Mfg Corp, Sterling, Ill. This company will be operated as a wholly owned subsidiary of Chicago Metal Hose Corp.

BUILT UP to STAND UP!

ight: "Buffalo" In-uced Draft Rotors are ilt for punishment . . extra heavy-gauge ates and blades hot-veted together.

elow: Husky, massive, recision - built rotors nd shafts mean long, conomical service on our draft jobs.





Left: Bearings are self-aligning and water cooled . . . adequate in every respect for smooth running with minimum friction.

Induced Draft Fans that stand up far longer under the continual erosion of fly ash and persistent action of gases! "Buffalo" has been building Induced Draft Fans like this for a good many years—and scores of these have been on the job for *decades* with very little time out for repairs.

"METAL WHERE IT COUNTS." Yes, "Buffalo" Induced Draft Fans are "built up" at all points where we *know by experience* excess wear will occur. A look at the rotors, shaft and bearing at left will show you what we mean by "built up to stand up."

ACCESSIBILITY OF PARTS. When a part finally *does* wear out, minimum time is lost in replacing it . . . for all parts are readily accessible.

EFFICIENCY. As in all "Buffalo" Fans, these Induced Draft Fans have precision-balanced rotors and properly formed blades and housings to give maximum efficiencies. *Ask your local "Buffalo" representative for complete data, or write:*

BUFFALO FORGE COMPANY

488 BROADWAY BUFFALO, N. Y.

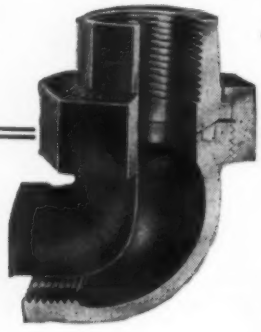
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" **DRAFT FANS**

JEFFERSON *Specialty* UNIONS

. . featuring the

RECESSED BRASS SEAT



. . eliminate unnecessary pipe joints

In addition to the 90° Union Elbow shown here, Jefferson Specialty Union are made in 45° Elbows and Union Tees of all types.

A common and exclusive feature of all Jefferson Unions is the Recessed Brass Seat providing a machined precision ground joint having true surface contact. Location of the seat is such that pipe ends cannot come in contact with it. Unrestricted flow through the joint is assured.

Jefferson Specialty units can be depended on for time and material savings because fewer pipe joints are required by their use.

Consult your nearest distributor—or write us direct—on your requirements.

JEFFERSON UNION CO.

601 WEST 26TH STREET, NEW YORK 1, N. Y.

LEXINGTON 73, MASS. **LOCKPORT, N. Y.**

THE WILLIAMS-HAGER FLANGED SILENT CHECK VALVE is positive insurance against costly "Water Hammer"—built of materials to meet the requirements of any service, and pressures up to 6000 pounds. Write for new descriptive Bulletin WH-50 today.

THE WILLIAMS *Gauge* COMPANY

2055 PENNSYLVANIA AVENUE

PITTSBURGH 12, PENNA.

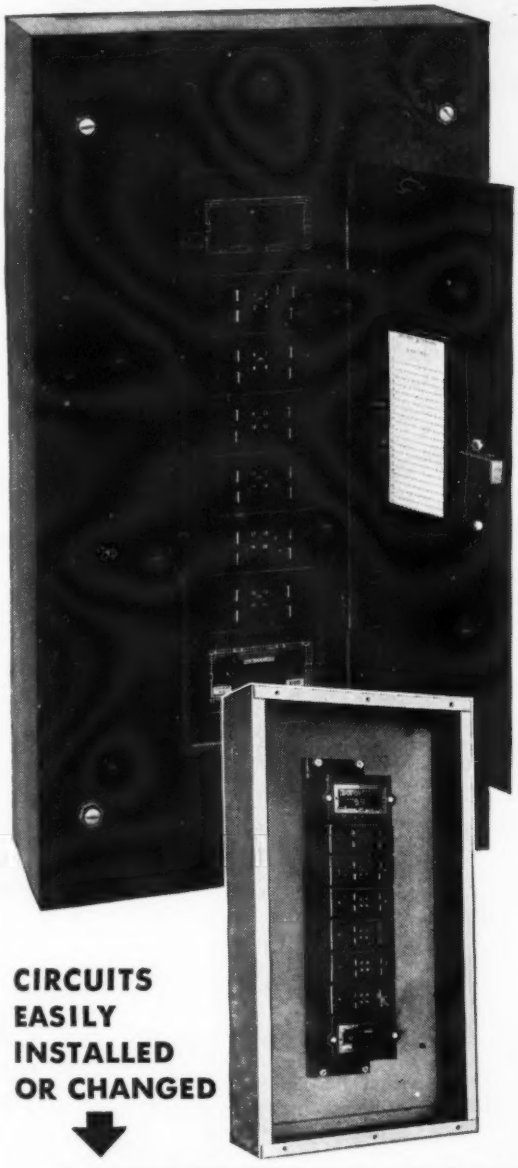
Ground has been broken for a new steam-generating plant that will be built by the Cambridge (Mass.) Electric Light Co on the western border of the Charles River Basin near the Longfellow Bridge. Capacity of the initial unit will be nominally 15,000 kw. Two B & W boilers, rated at 200,000 lb per hr, will be installed, each equipped to burn fuel oil or pulverized coal separately or simultaneously. Ingersoll-Rand feedwater heaters and Sturtevant fans will be provided and there will be a brick stack, 10 ft in dia and 175 ft high. The first generating set will be a Westinghouse machine, operating at 900 F and 1250 psi at the throttle, the boiler outlet pressure being 1350 psi. It is planned to run this turbine at 18,000 kw, as design of the plant provides for supplying industrial steam for heating and process service in that section of Cambridge, through bleeder operation and, if desired, from the boilers through reducing valves.

A 5-year program to increase the generating capacity of the Pennsylvania Electric Co by 140,000 kw in such areas as Warren, Ridgway, DuBois, Erie and Bradford was announced by W C Sontum, vice-president of the technical dept. Main points of the program are additions and improvements at Seward station, just north of Johnstown, the Penelec station in Erie and completion of the 70,000-kw station in Warren. In addition there are plans for changes in several transmission lines and substations to obtain maximum efficiency from the equipment. A new 30,000-lb-per-hr coal-burning boiler will be installed at Seward station to boost the output by 5000 kw. The Warren station, under construction since May 1946, will have the first 45,000-kw turbine in operation by midsummer of 1948 and the second 35,000-kw unit by summer of 1949. Total cost of this 5-year program is estimated at $16,400,000.

Metallizing Engrg Co, Long Island City, N. Y., announces a new method for hard-facing by using a metallizing gun and *Metco-Weld H*, a "wire" composed of a powdered hard-facing alloy extruded with a plastic binder. During spraying operation, plastic binder is completely volatilized and the deposit consists entirely of the metallic constituent. Subsequent fusing, with any fusing torch or with an attachment on a Metco metallizing gun, results in a coating, alloyed to the base and physically and chemically identical to hard-facings of the same alloy applied by other methods.

Central Louisiana Electric Co has begun construction on a $2,000,000 electric generating plant at St. Landry in Evangeline Parish. The new plant, named Coughlin Station in honor of the company's president, will be on Bayou Cocodrie about ten miles from Bunkie and 15 miles from Ville Platte. Two 7500-kw turbines will give the station a generating capacity sufficient to take care of the company's entire load. The company's Bunkie and Pineville plants, however, will be retained on a standby basis. In the past, part of the power sold by Central Louisiana Electric Co was bought from other generating companies.

NEW NMO "PLUG-IN" PANELBOARD WITH THERMAL-*Coilless* MAGNETIC MULTI-BREAKERS



CIRCUITS EASILY INSTALLED OR CHANGED

• This new NMO "Plug-in" Panelboard greatly improves the utilization of space on walls and columns because of its minimum overall size. Yet it has more gutter space (5½" gutters in 15" wide panelboard) due to the small size of MO4 Multi-breaker units. The narrow, column type has twice the usual number of circuits ever before available in cabinets of similar height.

The high-speed, *coilless* magnetic and thermal trip of the MO4 breaker unit used in the NMO Panelboard, gives adequate time lag for starting motors and tungsten lamp inrush currents. It trips as fast as one-hundredth of a second at current values slightly above operating range.

and consider these PLUS FEATURES at no additional cost to you . . .

• Low heating, which permits small size, is achieved by exceptionally high silver content in the contacts, and the elimination of bolted current-carrying connections at the silver-surfaced buss bars through the use of the effective Square D positive-pressure contact jaws.

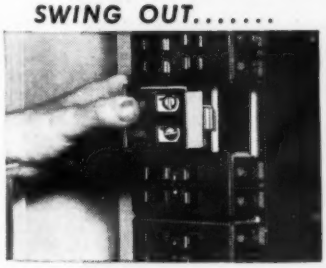
• The "Plug-in" feature permits easy removal and insertion of units for future changes in circuit ratings or additional circuits if space is originally provided.

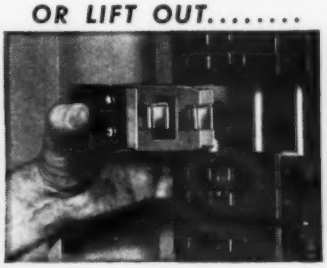
• The breaker units regularly provide four single poles which can be readily converted into two double poles by the insertion of handle ties, either in the field or at the factory, if specified when panelboard is ordered.

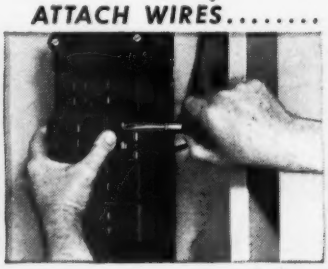
NMO Panelboards are furnished in 100 and 200 ampere mains ratings, 120/240 volt A. C. with 15, 20 and 30 ampere branch circuits.

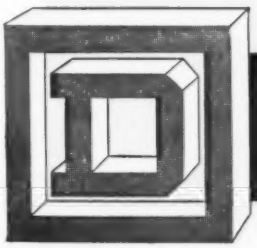
A BULLETIN giving complete information on the NMO "Plug-in" Panelboard is being sent to everyone on the Square D mailing list. WATCH FOR IT! ... If you do not receive your copy write Square D Company, 6060 Rivard Street, Detroit 11, Michigan.

SWING OUT..... *OR LIFT OUT.....* *ATTACH WIRES.....* *"PLUG-IN"*









SQUARE D COMPANY

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SQUARE D CANADA, LTD., TORONTO, ONTARIO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

JOIN THE TREND – Experience with both Proves Open Bucket Best

Experience of steam trap users has proved that, for smoother operation, open bucket type traps are superior for all-round service.

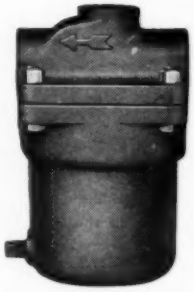
"Cub" discharges both air and condensate

It is not enough that a WRIGHT-AUSTIN "Cub" steam trap shall efficiently remove air and condensate from service lines—it must be qualified to live up to the expectations of every user. That it does this is proved by the large volume of repeat orders.

These are the qualities you will find in "Cub" open bucket type steam traps—qualities which contribute to world-wide acceptance and use:

No. 50 "Cub" Airxpel Open Bucket type Steam Trap

Double Rating on continuous discharge
No Waste of Steam
Stainless Steel valves, seats and buckets
Easy to Install
Water Seal entirely within trap

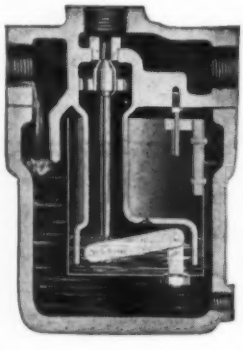


No. 51 "Cub" Airxpel Open Bucket type Steam Trap

All sizes of "Cub" Steam Traps are suitable for pressures up to 250 psi. Other types of Airxpel Steam Traps available for pressures up to 700 psi.

You'll find complete details in Circular 259-A.

Send for a copy today.



Inside the "Cub"

This view shows the inside water seal which prevents waste of steam. It shows also straight through pipe connections and accessibility of valve and seats.

No. 52 "Cub" Airxpel Open Bucket type Steam Trap

Send for Circular 259-A

WRIGHT-AUSTIN COMPANY
316 West Woodbridge St. Detroit 26, Mich.

WA Standard with STEAM USERS SINCE '94

WRIGHT-AUSTIN
SERVING INDUSTRY FOR MORE THAN 50 YEARS

Secretary of Interior Krug reports that conversion is again under way of Missouri Ordnance Works, near Louisiana, Mo., from synthetic ammonia to synthetic liquid fuels production. The Bureau of Mines started this changeover late in 1945, following an extended delay that was caused when the War Dept took back the plant for emergency production of ammonia for fertilizers. The Bureau of Mines recently took over the $17,500,000 plant and completed the return transfer of 79 engineering and administrative personnel from Torrance, Calif., to Missouri on July 20, about a year after the property was returned to the War Dept at direction of Office of War Mobilization and Reconversion. Design work continued during the year at Torrance, headquarters for Bechtel Corp, which holds a $6,780,000 contract for engineering, design, and construction necessary under the conversion program. Equipment, grading and housing subcontracts, totaling about $4,000,000, have been placed. The construction schedule calls for the Missouri plant to be producing gasoline and oil from coal and lignite by June 30, 1948.

Federal Power Commission has authorized issuance of a 35-year license to Georgia Power Co of Atlanta, Ga., for a hydroelectric project at Furman Shoals on the Oconee River about four miles from Milledgeville, Ga. The project, to be operated as a hydroelectric storage development, will consist of a dam in Baldwin County about 100 ft high with over-all length 2780 ft, including a spillway section with 24 crest gates, two bulkhead sections, a powerhouse intake section, and an earth-filled section with a concrete core wall; a powerhouse containing two 30,500-hp turbines connected to two generators, each with 22,500-kw capacity; a reservoir covering about 15,000 acres at normal elevation, and a step-up transformer station.

Ansco's new $2,400,000 power plant in Binghamton, N. Y., is scheduled for operation in the near future. The power plant will be used initially to generate steam for manufacturing operations, and subsequently to produce electric power for Ansco's needs. Construction of the plant was begun two years ago after it was decided that normal manufacturing would be hampered by existing facilities and that plans for expansion could not be mapped without additional boiler units. "One of the critical features of film manufacturing is a constant source of power of varying voltage and because of long transmission lines it is impossible to get that kind of power in a metropolitan area," said Allan Williford, general manager.

Public Service Dept of Burbank, Calif., has announced a 5-year, $6,000,000 construction program topped by a $2,000,000 steam-generating plant. J H Cambridge, manager, said that this project, to be built adjacent to a present plant on Magnolia Blvd, will double the system's capacity. Burbank sells 14,000,000 kwhr monthly. First step in the 5-year program is a 25,000,000-gal reservoir at the mouth of McClure Canyon, now under construction. Also under way is a $2,500,000 substation.

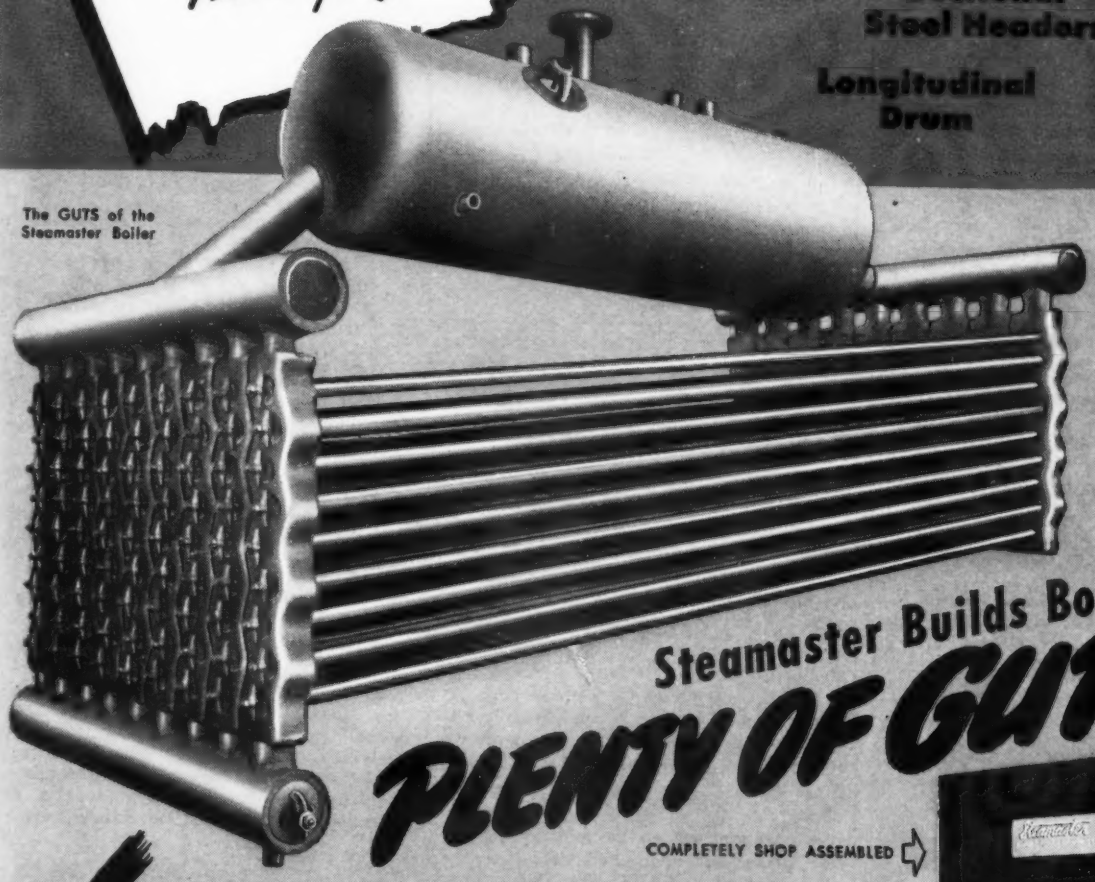
If you designed your own boiler — you would be sure it had Plenty of Guts!

Water Tube Design

Inclined Tubes

Sectional Steel Headers

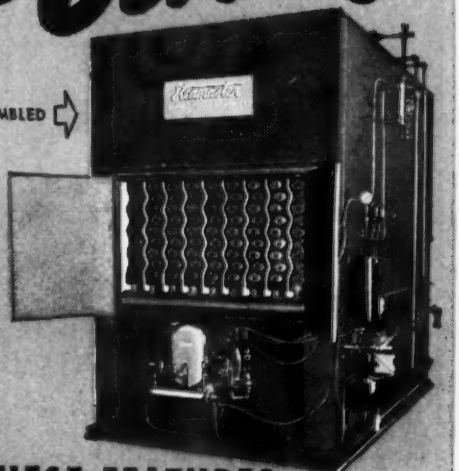
Longitudinal Drum



The GUTS of the Steamaster Boiler

Steamaster Builds Boilers with PLENTY OF GUTS!

COMPLETELY SHOP ASSEMBLED



CHECK *the features you would include if you designed your own boiler*

- ☐ Water Tube Design.
- ☐ Inclined Tubes.
- ☐ Sectional Steel Headers.
- ☐ Longitudinal Drum.
- ☐ All Steel Construction.
- ☐ Positive Tidal Circulation of Water —maintains all parts at equal temperature.
- ☐ Condensate Return System built-in as an integral part of all boilers of 60 h.p. and up.
- ☐ Easy Inspection and Maintenance —every tube immediately accessible. Just open the heavily insulated access doors.
- ☐ Large Combustion Area — Three-pass heat baffling gives high thermal efficiency.
- ☐ Choice of Fuel—gas, oil or coal or any combination of these fuels to meet fuel requirements of your plant.
- ☐ Fully Equipped for Automatic Operation—with the finest accessories. As nearly automatic as a boiler can be.
- ☐ A.S.M.E. CODE—National Board Approved. Inspected and certified by Hartford Steam Boiler Inspection and Insurance Co.
- ☐ Full Range of Sizes from 10 h.p. to 300 h.p. as illustrated. The Model A for 3½ h.p., 5 h.p. and 7½ h.p.
- ☐ Can Be Fired Over Rated Capacity and still maintain high thermal efficiency.

THESE FEATURES..... are built in all steamaster Boilers from 10 horsepower to 300 horsepower.

Steamaster

AUTOMATIC BOILER CO.

Compton at Slauson Los Angeles 11

SALES AND SERVICE IN ALL PRINCIPAL CITIES

Power Engineers Agree: STEAMASTER is the Boiler with PLENTY OF GUTS!

EXTRA SERVICE

"STANDCO"
PILLOW BLOCKS

There's Extra Value in these rugged well-designed "Standco" Pillow Blocks with their life-long, trouble-free service.

They are fully able to "take it," and have babbitted, accurately broached bearing surfaces, with faces machined to a "T". Easy to clean, easy to lubricate.

Write for Bulletin.

"Unbrako" and "Hallowell" Products are sold entirely through Industrial Distributors

Over 44 Years in Business

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA., BOX 577
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Makes ALL VALVES *INSTANTLY* Accessible

CONTROL FROM THE FLOOR

● Instant, handy, safe control of overhead and other out-of-reach valves. Eliminate danger to employees; banish the stepladder. Now — install valves anywhere they should be, regardless of accessibility.

Inexpensive BABBITT Sprocket Rims fit all types and makes of valves, with either rising or non-rising stems. Installed quickly by clamping directly onto hand wheel of valve. Eliminates makeshift apparatus and specially-made chain wheels.

● Ten standard sizes take care of all valve wheels from 2 to 30 inches in diameter.

● *Request Catalog Bulletin P, prices, name of local distributor:*

Babbitt Adjustable SPROCKET RIM with Chain Guide

BABBITT STEAM SPECIALTY COMPANY
Manufacturers of Adjustable Valve Operating Mechanisms
New Bedford, Mass., U. S. A.

BOOKLET REVIEWS

EXPLORATION, RESERVES, BED CHARACTERISTICS AND STRIP-MINING POSSIBILITIES OF A LIGNITE DEPOSIT NEAR TOLEDO, LEWIS COUNTY, WASH. *By Albert L Toenges, Louis A Turnbull and Willard A Cole, mining engineers, Bureau of Mines. Send 35¢ for copy of Technical Paper 699 to Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.* Technical report released by Bureau of Mines describes a recoverable reserve of more than 8,000,000 tons of lignite coal, nine miles east of Toledo, Wash., in the center of the Pacific Northwest's wartime fuel-famine area. A suggested plan of development is included.

A GUIDE FOR REDUCING FUEL CONSUMPTION IN COMMERCIAL PLANTS. *By J F Barkley, chief of fuels utilization div of Bureau of Mines, Thomas C Cheasley, former supervising engineer, and K M Waddell, former assistant supervising engineer, both of the national fuel-efficiency section. Send 50¢ for copy of Bulletin 466 to Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.* Bureau of Mines has combined in a single publication all of the material used successfully in the wartime National Fuel Efficiency Program that resulted in saving millions of tons of coal annually and in proportionate savings in other fuels.

EXPERIMENT IN UNDERGROUND GASIFICATION OF COAL, GORGAS, ALA. *Available on request to Bureau of Mines, Dept of Interior, Washington 25, D. C.* Report of Investigations 4164 describes pioneer accomplishments of the first government-sponsored attempt to burn unmined coal to produce gas in the U. S. The successful gasification experiment, conducted jointly by Bureau of Mines and Alabama Power Co at Gorgas, Ala., between Jan 21 and Mar 12, 1947, represented an important phase of the Bureau's comprehensive research program on carbonizing properties of coal and by-product yields and the production of synthetic-liquid fuels.

APPROVED EQUIPMENT FOR INDUSTRIAL FIRE PROTECTION (1947 edition) *Available on request to properties insured in the Associated Factory Mutual Fire Insurance Companies. Available to others by remitting $2 a copy to Inspection Dept, 184 High St, Boston 10, Mass.* The new edition lists not only names of manufacturers and specific devices which have been tested and approved by Factory Mutual laboratories, but also contains typical illustrations, valuable engineering data and recommendations on the use of equipment.

INDEX TO ASTM STANDARDS (Dec 1946) 242 *pp*, 8½x5¾, *paper. Available on request to American Society for Testing Materials*, 1916 *Race St, Philadelphia 3, Pa.* This publication is an adjunct to the 1946 *Book of Standards* and enables any of the 1400 standard specifications and tests in the volumes to be located readily. It is also of service to those who wish to determine whether ASTM has issued standard specifications, test methods or definitions covering a particular engineering material or subject.

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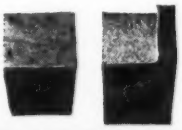
REFRACTORY COATING

Resists
ABRASION

PROTECTION against abrasion is an outstanding advantage of Brickseal. Here are two refractory bricks, one coated with Brickseal, the other uncoated. They were heated to more than 2000°, taken directly from the furnace, cooled and shoved against an emery wheel. Hot and cold, the Brickseal-treated brick resisted the abrasion – see below.

Brickseal consists of high fusion clays and metal oxides combined in oil. Furnace heat burns away the oils and vitrifies the clays and metals which penetrate deeply into the pores, cracks and joints. Brickseal prevents cracking, spalling and slagging regardless of sudden temperature changes. Brickseal is also a mortar for laying up refractory walls.

Compare the Brickseal-treated brick at the left to the untreated at the right.



TRY IT YOURSELF
on your emery wheel

Two bricks bonded together and partially coated with Brickseal will be mailed to you on request.

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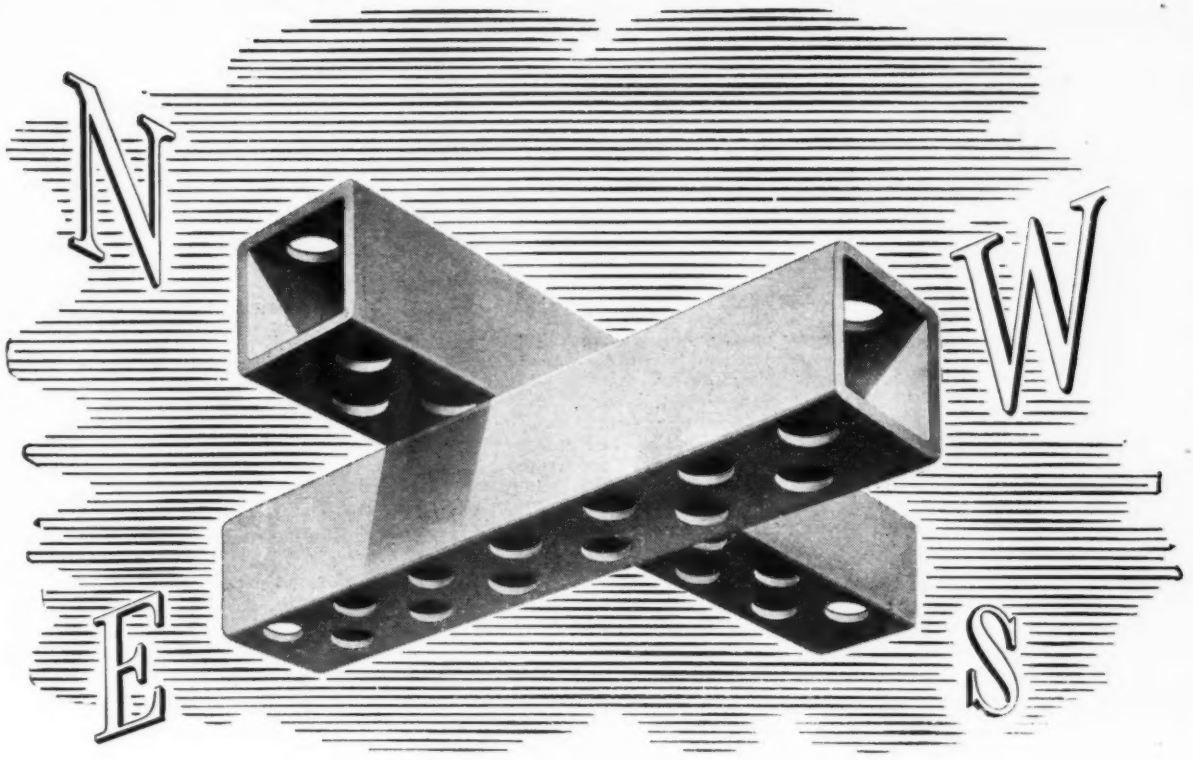

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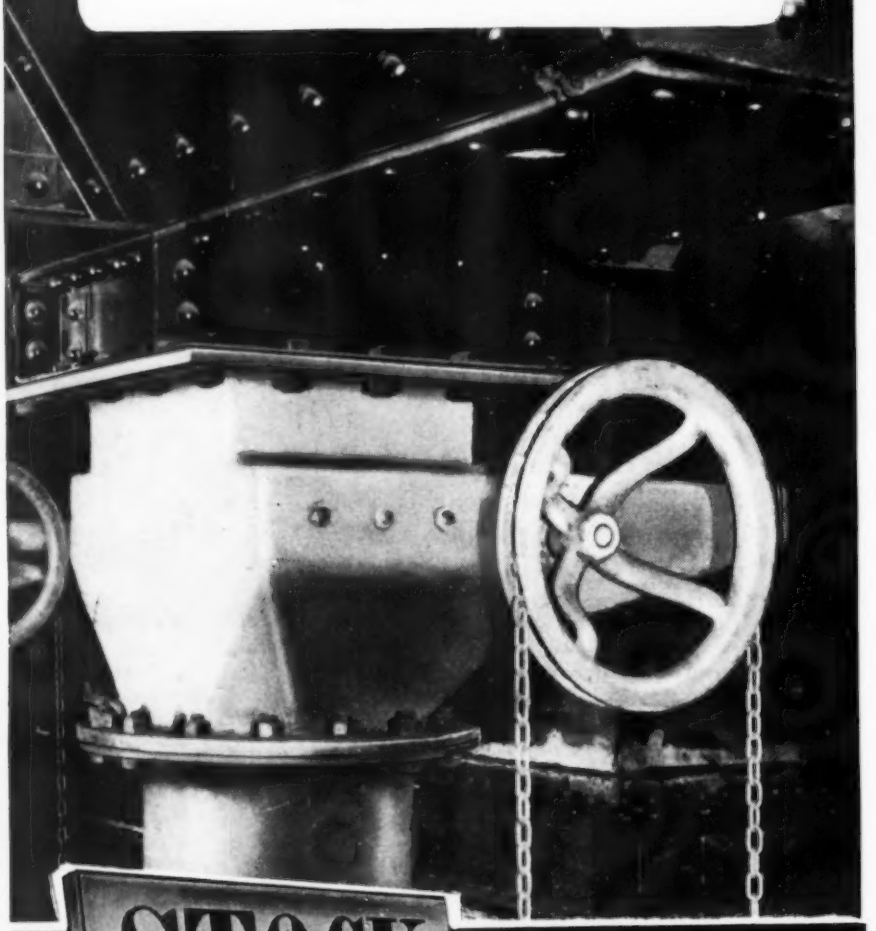

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S.E.CO. Coal Valves and Coal Scales

19 **LEATHER BELTING**—J E Rhoads & Sons, 35 N 6th St, Philadelphia 6, Pa. 24-page handbook contains engineering data for design and installation of Rhoads Tannate-Rockwood drives.

20 **ADJUSTABLE-SPEED DRIVE**—Reliance Electric & Engrg Co, 1066 Ivanhoe Rd, Cleveland 10, Ohio. 4-page bulletin No. 311-A covers features and applications of company's all-electric adjustable-speed drives in the higher hp ratings.

METERS AND INSTRUMENTS, MECHANICAL

21 **TURBIDITY RECORDER**—Ess Instrument Co, Bergenfield, N. J. 2-page bulletin No. 604 gives operation and application of the new TR-6 turbidity recorder.

22 **TORQUE INDICATORS**—Blackhawk Mfg Co, Milwaukee 1, Wis. 4-page bulletin No. 46T lists six torque indicator models, with capacities ranging from 50 to 1000 ftlb.

23 **ELECTRONIC SCRIBER**—Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill. 8-page bulletin No. C2-1 describes a new electronically operated scriber for measurement, indication, control and permanent record of variables.

24 **GAS INDICATORS**—Gow-Mac Instrument Co, Newark 5, N. J. 4-page booklet No. RF 8-47 discusses Gow-Mac Ever-Tite thermal conductivity units for gas analysis.

PIPING, FITTINGS, VALVES AND SPECIALTIES

25 **STEAM SPECIALTIES** — Wright-Austin Co, 315 W Woodbridge St, Detroit 26, Mich. 4-page bulletin No. CI47 covers steam traps, steam separators, strainers, gage glass protectors, air relief valves, low-water signals, etc.

26 **WROUGHT-IRON PIPING**—A. M. Byers Co, Pittsburgh, Pa. 20-page booklet tells what wrought iron is, why it resists corrosion and withstands shock and vibration, how it is made, and how it is bent, welded and threaded. The various services for wrought iron pipe and plates are also discussed.

27 **HIGH-TEMPERATURE VALVES** — Kerotest Mfg Co, 2525 Liberty Ave, Pittsburgh, Pa. 4-page booklet No. 47-AS describes Kerotest stainless- and alloy-steel valves for industrial, chemical, processing and refinery services.

28 **FLOW-REGULATING VALVE** — Swartwout Co, 18511 Euclid Ave, Cleveland 12, Ohio. 2-page data unit No. S-208 presents the new V10 flow-regulating valve. Design details are described and pictured to reveal features appropriate for drainage control of stage heaters, evaporator coils, flash tanks or process systems having high pressure drop and flashing condensate.

29 **STAINLESS-STEEL FITTINGS** — John B Astell & Co, 90 W Broadway, New York 7, N. Y. 4-page folder explains fabrication of Robinson light-wall stainless-steel welding fittings.

PRIME MOVERS AND ACCESSORIES

30 **HYDROCARBON THERMODYNAMICS**—Clark Bros Co, Olean, N. Y. 14-page reprint, entitled "Tentative Partial Enthalpies of the Lighter Hydrocarbons," discusses the thermodynamic approach to evalution of the heat associated with transfer of material from a gas to a liquid phase for pure hydrocarbons and multicomponent mixtures.

31 **GAS AND LIQUID FILTERS**—Drico Industrial Corp, 29 Broadway, New York 6, N. Y. 46-page booklet explains the Vokes principles of filtration and their applications. This booklet includes a discussion on filtration of air and oil for internal combustion engines and compressors.

32 **OIL FILTERS**—Wm W Nugent & Co, 410 N Hermitage Ave, Chicago 22, Ill. 4-page bulletin describes Nugent oil filters for fuel and lubrication of internal combustion engines.

Cold Facts...

...ON LUBRICANT PERFORMANCE

This special refrigerating apparatus at Sinclair Laboratories tells an important story every day to research experts and refinery control technicians.

The thermometers, shown above inserted in lubricating oil samples, record temperature as cold is increased in the special refrigerating apparatus. Trained observers check the samples frequently, test for pour point. Sinclair, thus, makes sure that its lubricants retain full protective qualities even at sub-zero temperatures . . . when your specific application demands.

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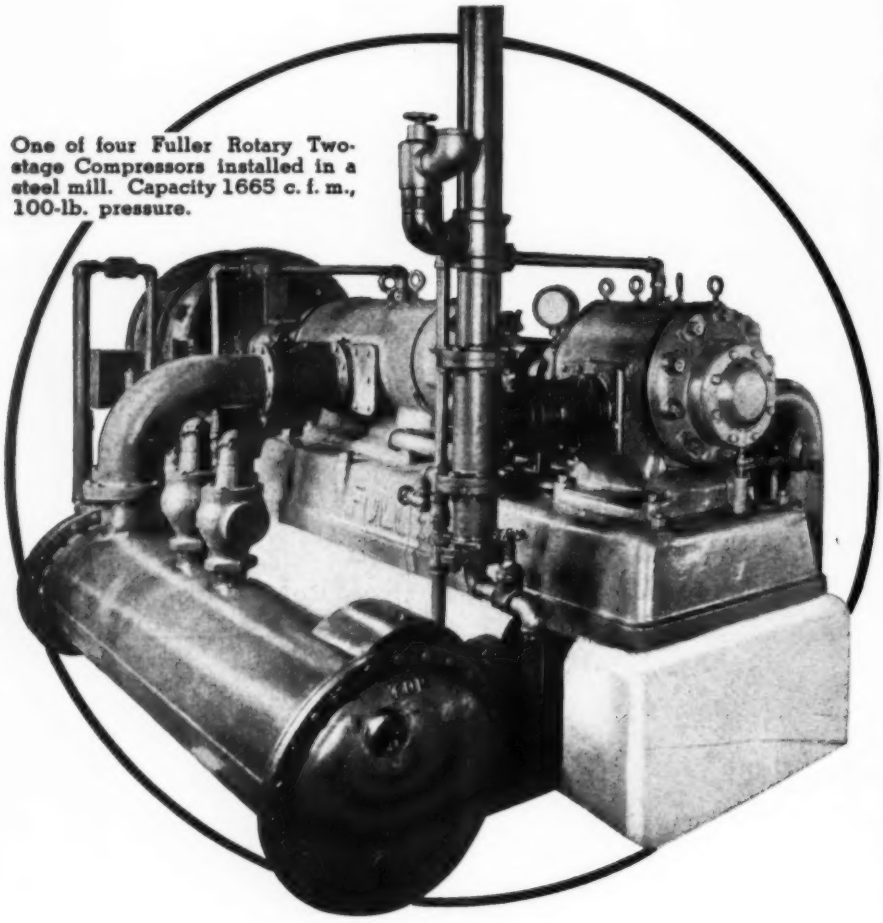
A lifetime of new machine efficiency ... that's what you get when you purchase a Fuller Rotary Compressor ... because they're built for that kind of efficiency and service. No adjustments or take-ups, no valves to leak or seats to grind. Result — the original capacity of a Fuller is maintained always. Fullers have many other worthwhile features, which we invite you to investigate. They're built for capacity to 3300 c. f. m., pressures to 125-lb.



One of four Fuller Rotary Two-stage Compressors installed in a steel mill. Capacity 1665 c. f. m., 100-lb. pressure.

Bulletin 5-C illustrates and describes Fuller Rotary Compressors and Vacuum Pumps. Write for your copy.

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C-156

FULLER

A LIFETIME OF NEW MACHINE EFFICIENCY

PUMPS

33 CENTRIFUGAL PUMPS — Goulds Pumps, Inc, Seneca Falls, N. Y. 12-page bulletin No. 710-1 discusses single-stage inclosed-impeller centrifugal pumps.

34 SLURRY PUMPS — Pettibone Mulliken Corp, 4710 W Division St, Chicago 51, Ill. 16-page bulletin on a new slurry pump gives detailed description, engineering and pumping data, selection chart, dimensions, assembly drawings and parts list.

35 POWER SLUSH PUMP—National Supply Co, Box 899A, Toledo 1, Ohio. 16-page bulletin No. 320 describes features of Ideal power slush pump Type C-350.

OTHER EQUIPMENT

36 CORROSION-RESISTANT EQUIPMENT—Duriron Co, Dayton 1, Ohio. 8-page general catalog J gives a brief description of every type of corrosion-resistant equipment produced by the company. The equipment includes pumps, pipe, valves, fans, heat exchangers, steam jets, ejectors, tank outlets and mixing nozzles.

37 AIR COMPRESSORS—Davey Compressor Co, Kent, Ohio. Air-compressor leaflet contains mechanical data and specifications on complete Davey departmental units of 60-, 105-, 160-, 210-, and 315-cfm capacities.

38 ELECTRONIC SERVO SYSTEMS—Askania Regulator Co, 240 E Ontario St, Chicago 11, Ill. Booklet describes Askania electronic servo systems for remote positioning of dampers, valves and other mechanisms.

39 AIR-OPERATED CONTROLLERS—Brown Instrument Co, Wayne & Roberts Ave, Philadelphia 44, Pa. 40-page catalog No. 8905 discusses control instruments for temperature, pressure, flow, liquid level and humidity.

40 DIFFERENTIAL CONTROLLERS—Brown Instrument Co, Wayne & Roberts Ave, Philadelphia 44, Pa. 48-page catalog No. 2221 presents instruments and systems for measurement, indication, recording and control of flow and liquid level.

41 OVERHEAD TROLLEY — Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill. 8-page folder No. 2241 describes the Link-Belt ball-bearing overhead conveyor trolley.

42 TOOL AND HIGH-SPEED STEEL—Allegheny Ludlum Steel Corp, 2020 Oliver Bldg, Pittsburgh 22, Pa. 62-page catalog contains indices of all high-speed and tool steels marketed by Allegheny Ludlum through its warehouse system.

43 CORROSION-RESISTING ALLOYS Duriron Co, Dayton 1, Ohio. 4-page bulletin No. 100, entitled "Guide to Selection of Durco Corrosion Resisting Alloys," lists 155 corrosives in alphabetical order and shows which of five Durco alloys offers most satisfactory resistance to each corrosive.

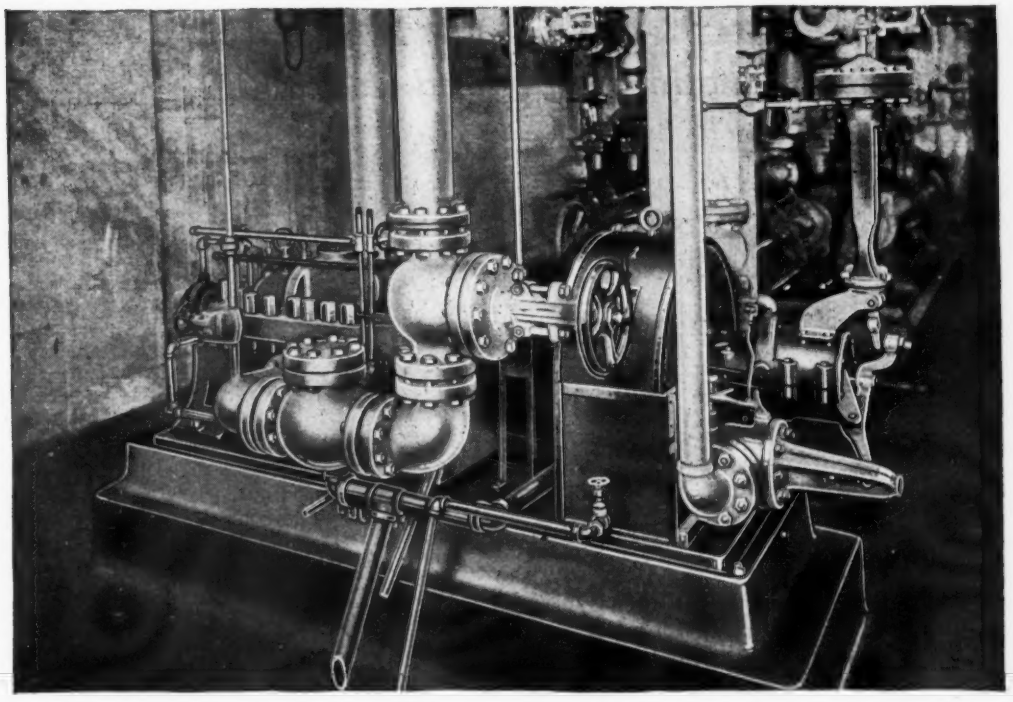
44 INSULATION TESTERS—James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa. 76-page manual No. 21J-49 contains up-to-date information on insulation resistance testing and how to use the various Megger insulation testers.

45 BOILER SCALE REMOVAL — American Sand-Banum Co, 9 Rockefeller Pl, New York 20, N. Y. 16-page booklet No. F300-2-47-5M tells how and why Sand-Banum is solving the boiler scale problem.

46 WATER DEMINERALIZERS — Ion Exchange Products Dept, American Cyanamid Co, 30 Rockefeller Pl, New York 20, N. Y. 26-page booklet, entitled "Filt-R-Stil Demineralizers Deliver Low-Cost, Chemical Equivalent of Distilled Water," cites advantages of demineralized water over distilled water, describes chemical and mechanical principles of demineralization by ion exchange, and gives data on calculating costs for demineralizing various raw waters.

47 WELDING FUME EXHAUSTER—Mine Safety Appliances Co, Braddock, Thomas and Meade St, Pittsburgh 8, Pa. Bulletin No. CU-1 discusses the new MSA portable welding fume exhauster.

TERRY



THE BLADES OF THIS BOILER FEED PUMP TURBINE ARE DOUBLE RIM PROTECTED

The 55 H.P. Turbine shown above employs the Terry Solid Wheel Rotor. The wheel is made from a single steel forging and the buckets are milled directly in the wheel.

The buckets are protected by rims at the sides of the wheel as shown in the illustration at the left. These rims would take without damage any rubbing that might occur if the clearance became reduced.

With this construction it is impossible for the blades to foul and frequent inspections of the thrust bearing are not required to obtain safe and dependable operation.

The Terry Wheel Turbine is fully described in our Bulletin S-116.

T-1170

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APPOINTMENTS

Raybestos - Manhattan, Inc, has announced the following appointments in its equipment sales div: Harry C Dishman, equipment sales manager with headquarters in Detroit; George T Young, branch manager of Detroit office; E E Juergens, branch manager of Cleveland office; and John E Cole, branch manager of Chicago office. Asbestos products div has named David E Gow packing sales manager, with headquarters in Manheim, Pa.

Harvey A Mylander has been named district manager for southern Calif. and Ariz. for **De Laval Steam Turbine Co.** His headquarters will be at 124 W Fourth St, Los Angeles.

Nordberg Mfg Co has promoted four divisional managers to vice-presidents: Roland W Bayerlein, heavy machinery; H H Talboys, railway equipment; D A Cheyette, crusher; and R R Shafter, process machinery.

James B Elliott has been made divisional sales manager of **Link-Belt Co** plant in Minneapolis, Minn. Erwin A Wendell has been appointed divisional sales manager for Caldwell plant products, with headquarters at Caldwell plant. T W Matchett has been named district sales manager, Chicago branch, with headquarters at Pershing Rd plant. Albert Musschott has been made assistant to chief engineer, with headquarters at company's general office in Chicago.

Westinghouse Electric Corp has appointed T P Lagrone manager of customer section, central station sales dept, E Pittsburgh, Pa. H W Lingenfelter has been named manager of commercial, industrial and floodlighting sales for lighting div in Cleveland. Dr R C Mason has been made manager of electro-physics dept of Westinghouse research laboratories, succeeding Gaylord W Penney, who was recently appointed Westinghouse professor of electrical engineering at Carnegie Institute of Technology.

Thomas S Wilmeth has been named assistant production control manager of **Allis-Chalmers** general machinery, West Allis Works. He succeeds R L Brueswitz, who resigned.

Chase Brass & Copper Co has promoted Edward J Malvey to position of advertising manager.

J K Rector has been made advertising and sales promotion manager of **Watson-Stillman Co.**

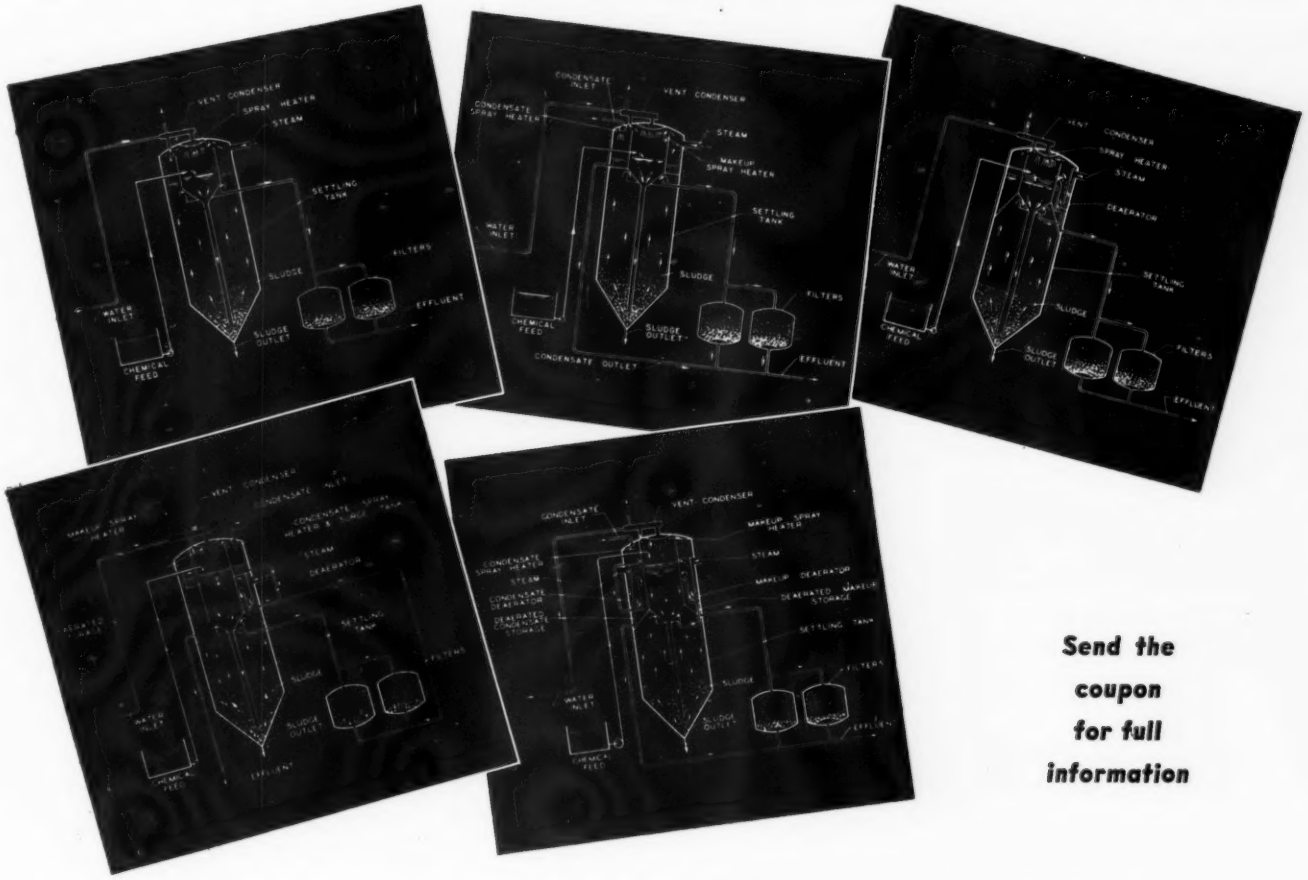
H L Boetsch has been appointed vice-president in charge of sales of **Pennsylvania Flexible Metallic Tubing Co,** Philadelphia. T R Boyle has been named manager of Chicago branch. J J Lynch has been made manager of Syracuse branch.

W S Ginn has been named assistant manager of sales in **General Electric's** power transformer section, transformer div. C B Davidson has been appointed southeastern

Not one, but....FIVE types of

LIQUON

HOT PROCESS WATER SOFTENERS



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No matter what your plant conditions, LIQUON can therefore provide the most effective and economical Hot Process installation.

Each type of LIQUON Hot Process Softener operates with a deep bed of suspended precipitated sludge through which the treated water percolates.

This LIQUON sludge-blanket principle produces a clearer water and uses less chemical than older types of settling tank softeners. It also reduces silica more efficiently.

The COMPLETENESS of LIQUON Service extends to EVERY requirement for liquid conditioning. Whatever your water softening or clarifying needs, consult LIQUON for authoritative advice and modern equipment, based on more than a quarter century of experience. Your inquiries are invited, without obligating you in any way.

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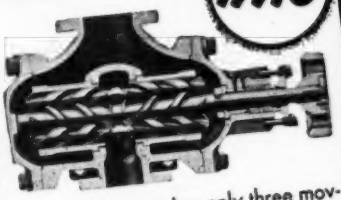
THE *PUMP* WITHOUT PISTONS, VALVES, BEARINGS, GEARS OR VANES

IMO



The IMO pump has only three moving parts—a power rotor and two sealing rotors — nothing to get out of order or to require adjustment. The IMO pump can be depended upon in hydraulic service, governor service, lubrication service and other applications in which continuity of operation and freedom from maintenance are vital.

For further information send for catalog 1-131-P.

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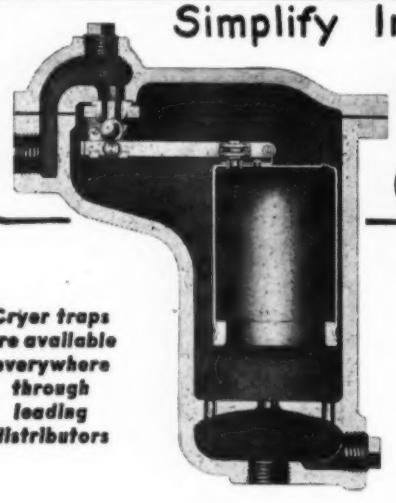
Simplify Installation and Maintenance *by Installing* CRYERS



Cryer traps are available everywhere through leading distributors

Here's what users say:

"...there has never been any sticking."
"...they are self cleaning"
"...there have been no replacements" (in three years).
"...they need very little care."
"...they really operate."

The obvious conclusion from experiences such as these is that you can keep out of Cryer Traps because there is seldom any occasion for getting into them. You can install them and forget them and be assured that they will function practically without attention. Full details on request.

Sizes: ½" to 2½" capacities: 500 to 38,000 lbs. of water; Pressures: to 250 lbs.

Also Thermostatic Radiator Traps, as well as all sizes of traps and repair parts for the line formerly known as the J-M Ball Steam Trap.

Manufacturers of Steam Specialties for over 40 years.

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district manager of construction materials sales for GE. William J Albrecht, member of the Erie, Pa., Works for 32 years, has been made superintendent of building, grounds and power div. He succeeds H C Mitchell, who has resigned. C H Auger has been appointed in charge of production engineering on aircraft gas turbines and turbosuperchargers at Lynn, Mass., River Works. John S Lennox, power transformer specialist, has retired from GE after 41 years of service. Victor E Goodwin, managing engineer of lightning arrester, cutout and capacitor divisions at Pittsfield Apparatus Works has retired from the company after 43 years of service. W A Reeves has retired from aircraft gas turbine div after 43 years of service with the company.

Hammel-Dahl Co announces appointment of O T Clarke, Clarke Sales Engrg Co, Decatur, Ga., as its dealer representative in Southeast territory.

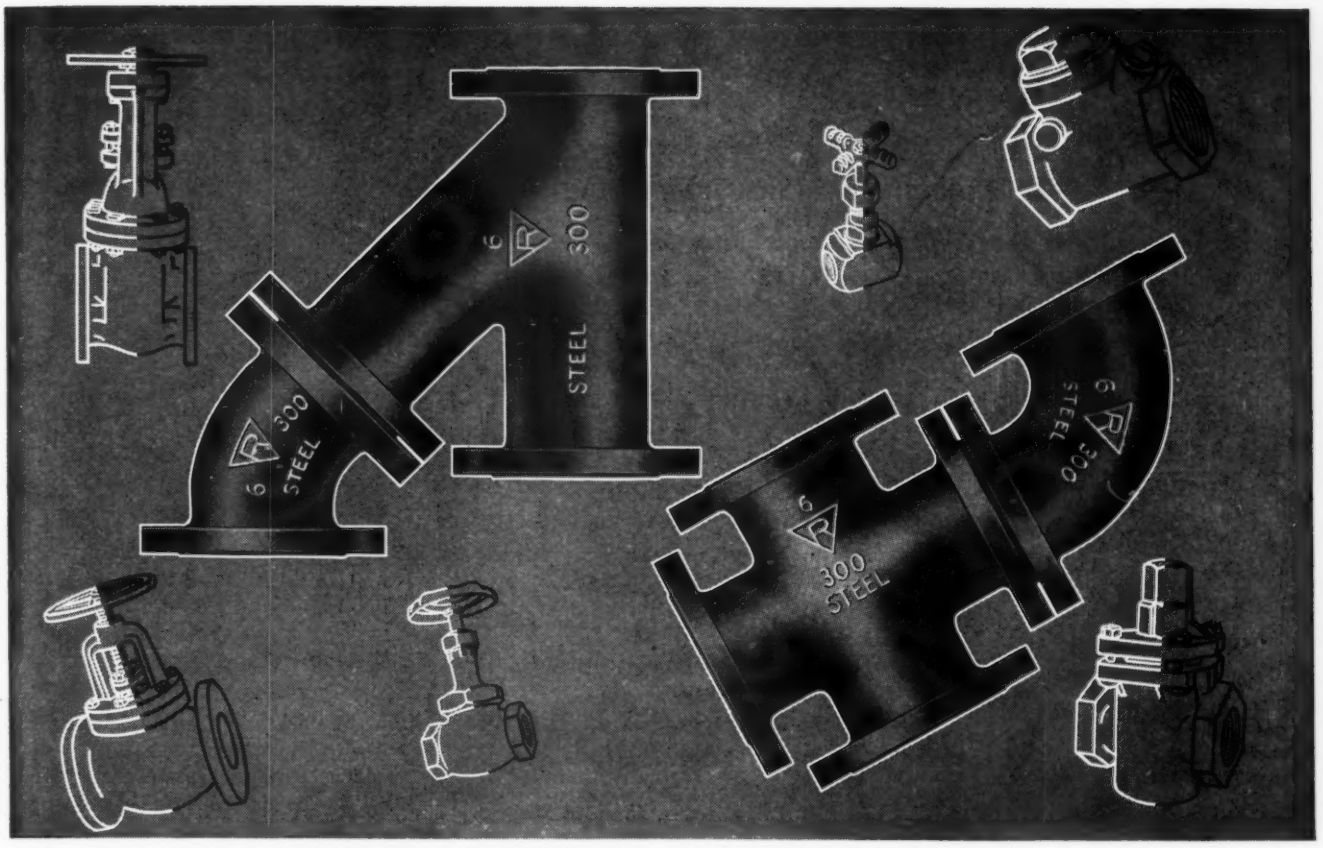
Fred F Loock has been elected president of **Allen-Bradley Co.** Harry L Bradley has been named chairman of the board, a capacity in which he will continue to be active in corporate direction of the company. Other officers, who were re-elected, are R W Whitmore, vice-president and works manager; Louis Quarles, secretary; and A F North, treasurer.

Burlington Instrument Co, has appointed following representatives to handle its line: (1) Balch Sales Co, Baker Bldg, Minneapolis 2, Minn., for Wis., west of and including counties of Ashland, Sawyer, Rusk, Chippewa, Eau Claire, Jackson, Monroe, Vernon, Richland, Crawford, Grant, and states of Minn., N. D. and S. D. (2) Woodman, Rayfield & Potter Co, 1570 Northside Dr N W, Atlanta, Ga., for states of Ga. and Ala.

Thermoid Co, Trenton, N. J., announces appointment of L I Berry as production engineer for molded hose div. M R Bell has been made assistant rubber production manager for Thermoid.

Promotion of six staff members of **Monsanto Chemical Co** central research dept, at Dayton, Ohio, has been announced: (1) Dr Wendell P Metzner has been promoted to associate director of research in rubber service dept of organic chemical div at Nitro, W. Va. (2) Dr Reid G Fordyce has been promoted to manager of sales development of plastics div at Springfield, Mass. (3) and (4) Dr Rudolph L Heider and Alfred B Craig have been appointed group leaders of process research and plastics evaluation groups, respectively, at central research dept. (5) Dr Earl C Chapin has been made acting group leader of a polymer research group at Dayton, replacing Dr Fordyce. (6) Dr George L Wesp has replaced Dr Metzner as acting group leader of another polymer research group.

Monsanto Chemical Co announces three appointments in research dept of central research laboratories: (1) Dr Robert A Staniforth has been made chief of chemistry section. (2) Dr Raymond Davis Jr has



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Your assembled piping systems require accuracy in dimensions. The precision with which they go together is important to you. Every R-P & C fitting is a fine pressure steel casting—accurately machined to close tolerances.

READING, PENNSYLVANIA — Reading-Pratt & Cady pioneered in the development of pressure steel castings for valves and fittings.

This fact is not important in itself. But constant improvements in engineering, in foundry and shop methods and in inspection techniques have resulted in better products—have given us the "know-how." R-P & C steel valves and fittings made today are better than ever before. And that is important to you.

Consider your Reading-Pratt & Cady distributor as a responsible source for cast steel globe, angle, gate and check valves, as well as cast steel fittings. He also offers a wide range of bronze and iron valves.

ACCO

TRADE MARK

READING-PRATT & CADY DISTRIBUTORS IN PRINCIPAL CITIES

Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit • Houston • Los Angeles • New York • Philadelphia • Pittsburgh • Portland, Ore. • San Francisco • Bridgeport, Conn.

READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

STICKLE HEATERS

—for Greater Heating Capacity in Less Space

—for Gaining Maximum Value from Exhaust Steam

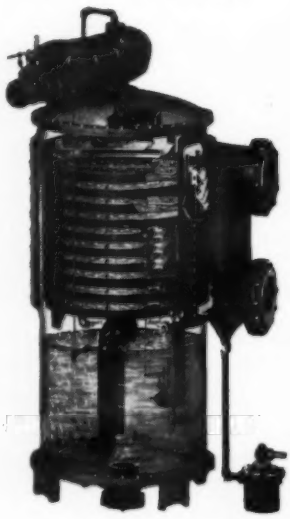
—for Boiler Feed Supply of Purer Water

—for Efficient Trouble-free Operation

—for Type and Size to Meet Specific Needs

SIMPLE • POSITIVE • EFFECTIVE

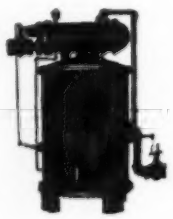
Here is Why

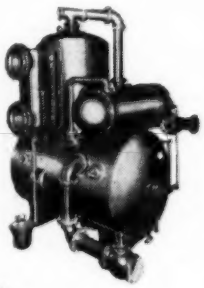


Raw makeup water enters heater at top and travels downward by flowing over a series of open coils, permitting transfer of heat from steam which fills the chamber. Lime and magnesia released and deposited on coils or pans. Oxygen and other non-condensable gases are eliminated.

Water flows in thin film, and in tortuous courses, over pans, and falls in thin streams and small drops, making transfer of heat from steam to water rapid. Condensation of steam used in heating becomes one-sixth of boiler feed supply.

● Consulting engineers who have watched their performance and steam engineers who have had them as equipment are alike impressed with the advantages of Stickle Feed Water Heaters and Purifiers. Stickle Open Coil Design assures effective results in daily operation, obviates upkeep cost, and makes possible a long and satisfactory service life. Ask for Bulletin No. 117.





Capacities from 3,000-lb. single heaters to 250,000-lb. dual heaters. Deaerating and Non-deaerating types. Cast iron or steel construction. Extra storage space when desired.

Descriptive bulletins and engineering data supplied on Stickle Differential Drainage and Boiler Return System, Stickle Open Float Steam Traps, Stickle Regulating and Reducing Valves, Stickle Temperature Control Valves, or Stickle Oil and Steam Separators.

STICKLE

STEAM SPECIALTIES COMPANY

SPECIALIZING FOR MORE THAN 40 YEARS IN REDUCING THE COST OF STEAM

2265 VALLEY AVENUE, INDIANAPOLIS 18, INDIANA

been promoted to group leader in physics. (3) Dr Wilson H Power has been named group leader of fundamental research.

C L Parish has been made maintenance superintendent of Aniston, Ala., plant of **Monsanto Chemical Co.** Herbert O Tittel has been appointed production superintendent of plant at Trenton, Mich. Monsanto has opened a new office in Widener Bldg, Philadelphia. This office will handle all Monsanto sales, with emphasis on organic, phosphate and Merrimac div products.

Potter & Brumfield Mfg Co has elected James T Watson to board of directors. James F Rinke has been appointed chief engineer.

Arthur Koehler has been named production manager of **Sorensen & Co.**

A L Holcomb Co, 15 Market Ave, N W, Grand Rapids 2, Mich., has been appointed an authorized distributor for **Carboloy Co.** In addition to Grand Rapids and the immediate Grand Rapids area, the A L Holcomb Co will also supply users throughout northwestern Mich. R R Miller, vice-president and sales manager of Holcomb, will head up the new Carboloy operation.

Sarco Co announces removal of its head offices to Empire State Bldg, New York 1, N. Y.

Paul D Davison has been named works manager of new **Evans Products Co** plant near Plymouth, Mich.

Selby F Greer has been appointed general sales manager for Kellogg div of **American Brake Shoe Co.** Charles S Sliter, who has been made assistant general sales manager, will continue to direct promotional and advertising activities of this div. Both men will be at the main plant in Rochester, N. Y. H O Holland, vice-president and former general sales manager, will assume new duties.

Metal & Thermit Corp has named O L Howland sales manager of welding div, with headquarters at 7300 S Chicago Ave, Chicago, Ill. As aide to Howland, Wm C Cuntz has been made assistant sales manager of this div, with headquarters at 1514 W North Ave, Pittsburgh, Pa.

Allan J Anderson has been appointed manager of **American Potash & Chemical Corp** plant at Trona, Calif. Anderson succeeds Walter J Metzger, who resigned.

Consolidated Engrg Corp has elected Dr Fred C Lindvall to board of directors.

William K Sims has been named engineering sales representative of **Milton Roy Co** in N. Y., N. J. and Conn. districts.

Brown Instrument Co, div of Minneapolis-Honeywell Regulator Co, has announced new sales and service engineering staff additions and promotions: (1) Edward B Kohl has been transferred to Corpus Christi. (2) I K Farley has been

Have FABRICATING PROBLEMS limited your field of design?

Your parts can be engineered for material and performance rather than convenience of fabrication if you specify HAYNES precision castings. Parts of intricate design can be produced in production quantities by this process to close dimensional standards so that finishing operations are reduced to a minimum.

HAYNES precision castings are available in a wide range of alloys that dominate the field where strength and hardness at high temperatures, and resistance to abrasion or corrosion are required. Among the alloys having this unique combination of properties and available as precision castings are HAYNES STELLITE, HASTELLOY, and MULTIMET alloys. Various stainless steels also are precision-cast by the HAYNES method.

Our engineers will be glad to discuss the possibility of producing your problem parts by HAYNES precision casting. Write to any office for further information.

The registered trade-marks "Haynes," "Haynes Stellite," "Hastelloy," and "Multimet" distinguish products of Haynes Stellite Company.

HAYNES TRADE-MARK *alloys*

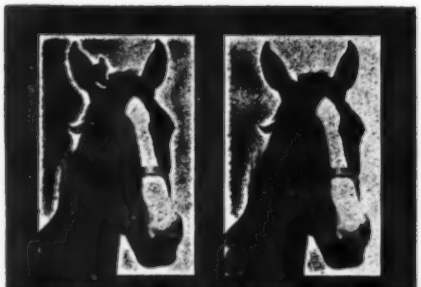
Haynes Stellite Company

Unit of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles—New York—San Francisco—Tulsa



WHAT'S THE DIFFERENCE?

Both racers look alike, but one look at their performance records is proof of hidden differences.

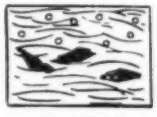
Hidden differences mean a lot in water treatment too. That's why K.A.T. was developed . . . to simplify water treatment in any boiler. Since All—Colloidal K.A.T. functions by physical action — not chemical reaction — it is effective against all impurities in any water regardless of composition.

ALL COLLOIDAL K.A.T. WATER TREATMENT

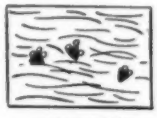
Effective as a complete or "finishing" treatment

- Removes and prevents scale accumulation
- Inhibits corrosion
- Safeguards steam purity
- Lowers fuel, labor, maintenance costs
- Permits almost continuous boiler operation.

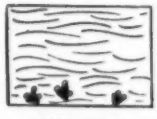
K.A.T



FIRST STAGE



SECOND STAGE



THIRD STAGE

It will pay you to test K.A.T. in your own plant today.

Literature on Request

Representatives in principal cities

• T. M. Reg. U. S. Pat. Off.

AMERICAN K.A.T. CORPORATION

331 Madison Ave. New York 17, N. Y.

Gentlemen:

Please send me free descriptive literature on K.A.T.

Name.....

Company.....

Address.....

City..... State.....

transferred to Houston. (3) John D Root has been made sales engineer at Philadelphia. (3) E Curt Richards has been transferred to New York sales engineering staff. (4) Thomas Pitts has been appointed industrial sales engineer at Charlotte branch.

Following men have been added to **Brown Instrument Co** branch-office field-service engineering staffs: (1) William E. Brittain, Philadelphia (2) Edward J Chance, New York (3) Ethron B Deebel, Philadelphia (4) Gerald R Dryden, Syracuse (5) John W Forbes, Albany (6) Carl R Haug, Philadelphia (7) Willard A Holm, New York (8) Roger F Lederer, Chicago (9) Albert J Leonaitis, Hartford, Conn. (10) Elgin H Dochte, Houston (11) John E Luttrell, Buffalo (12) Kenneth Shapleigh, Boston (13) Clayton K Taylor, Indianapolis (14) Robert H Walker, Cleveland (15) Frank M West, Boston.

Lincoln Electric Co has transferred A F Boucher to Milwaukee office at 753 N Van Buren St, as district manager. Marshall Ford has been made district manager for the Minneapolis office at 529 S 7th St.

Charles G Herbruck has been appointed assistant secretary of **James F Lincoln Arc Welding Foundation,** Cleveland.

Brockway Co announces appointment of Stephen Guarnaschelli as manager of Uniflex flexible metal hose div.

William E Clark has been elected a vice-president of Keystone div of **Dravo Corp** at Pittsburgh.

Welding fittings div, of **Tube Turns, Inc,** has named Lewis M Bound Jr West Coast manager, with headquarters in San Francisco.

Weatherhead Co has appointed A F Spring to newly created position of export manager. He will maintain his office at the main plant in Cleveland. William L Hauck has been made Eastern district sales manager, with headquarters at 4302 Lincoln Bldg, 60 E 42nd St, New York City.

Plant Rubber and Asbestos Works has appointed C J Colman general assistant to Vice-president A J Stream at the home office, 537 Brannan St, San Francisco.

Frederick J Riker has been named president of **Livingstone Engrg Co.** He succeeds Carter C Higgins, who has been elected chairman of the board.

Carborundum Co announces appointment of Dr Gurdon M Butler Jr as a senior engineer of research div.

Harry G Campbell has been named sales manager of DieseLight div of **Buda Co,** Harvey, Ill.

Dr Floyd J Metzger, vice-president in charge of liquefaction research of **Air Reduction Co,** has resigned. He will engage in private practice as consultant with offices at 60 E 42nd St, New York 17, N. Y., and will continue his connection

THE PEERLESS *Fluidyne*

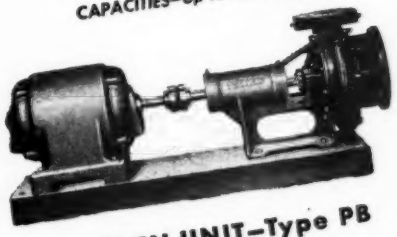
AN ECONOMICAL GENERAL UTILITY CENTRIFUGAL PUMP

PEERLESS PUMPS

ELECTRIC UNIT—Type PE

Sturdy, compact, close-coupled single stage design. Powered by standard stock NEMA motor. Highly efficient, versatile, durable; easy to install, operate and maintain. Utilizes small space. Versatile in use.

HEADS—Up to 270 feet.
DRIVES—Fractional to 20 H.P.
CAPACITIES—Up to 1000 g.p.m.



BELT DRIVEN UNIT—Type PB

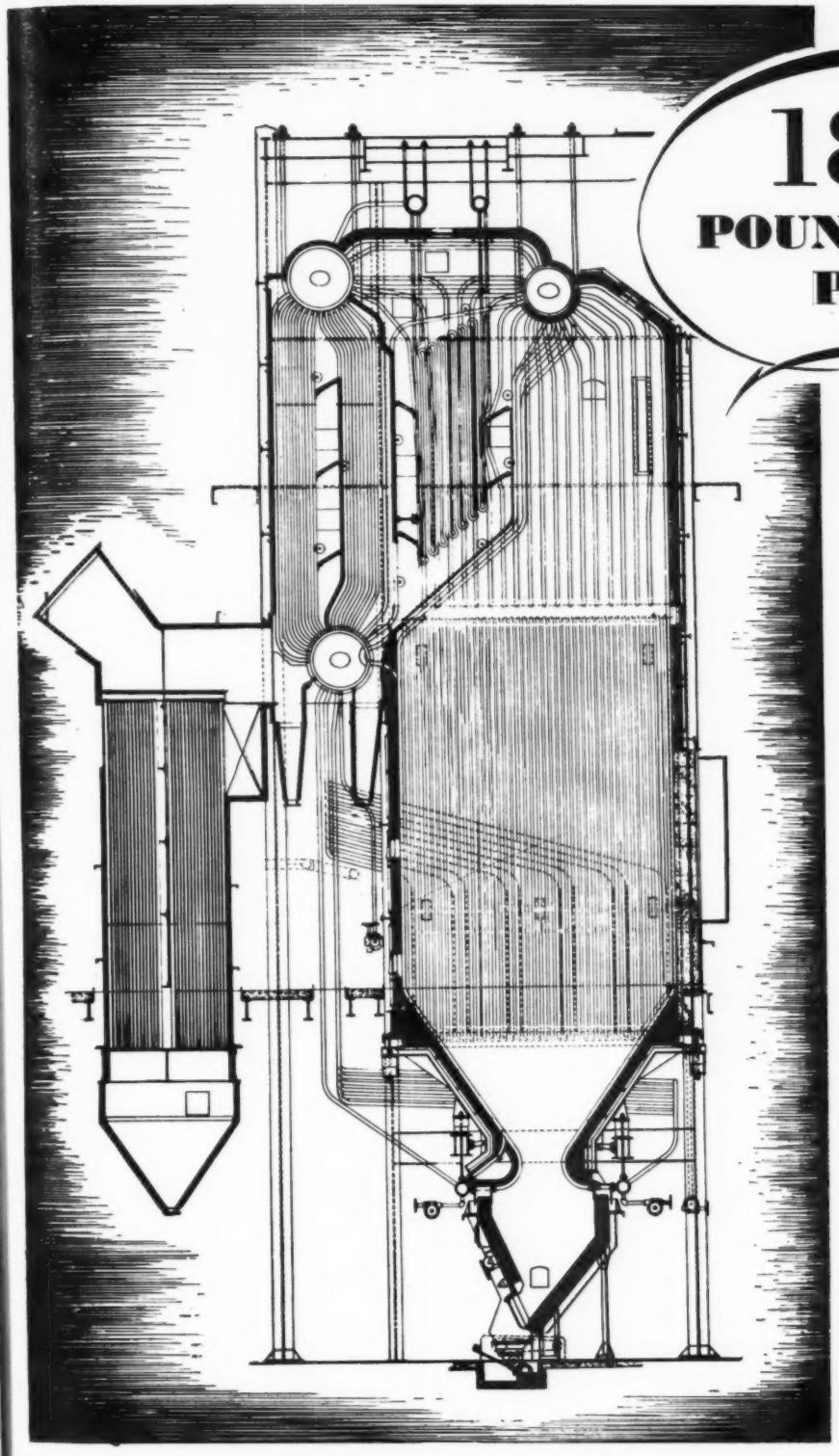
Steel shaft, turning in grease lubricated ball bearings is built to receive either V or flat belt pulley; or may be direct-connected as shown to standard stock horizontal motor through flexible coupling.

THE FLUIDYNE MOVES WATER AND OTHER LIQUIDS WHERE YOU WANT THEM. The Peerless Fluidyne is ideally applied to a host of commercial and industrial uses. A natural for system pump sub-assemblies. Handles water as well as slightly viscous or alkaline liquids. Operates in any position.

FOR FULL DETAILS, REQUEST YOUR COPY OF BULLETIN NO. B-165.

PEERLESS PUMP DIVISION
Food Machinery Corporation

Factories: Indianapolis, Indiana; Quincy, Illinois; Los Angeles 31, California. District Offices: Chicago 40, 4554 North Broadway; Philadelphia Office: Suburban Square, Ardmore, Pa.; Atlanta Office: Rutland Bldg., Decatur, Ga.; Dallas 1, Texas; Fresno, California; Los Angeles 31, California.



185,000
POUNDS OF STEAM PER HOUR

Purchaser—
Pennsylvania Electric Company

Location—
Front Street Station, Erie, Pa.

Number of Boilers 2

Pounds of Steam/Hr. . 185,000

Design Pressure . . . . 750 PSI

Operating Pressure . . 675 PSI

Total Temperature . . 835° F.

Air Preheater—
Erie City Tubular—2 Pass

Water Walls—
Erie City Bare Tube

Temperature of Air for
Combustion—530° F.

Four additional Erie City Units at higher pressure and temperature are now in production for the same company.

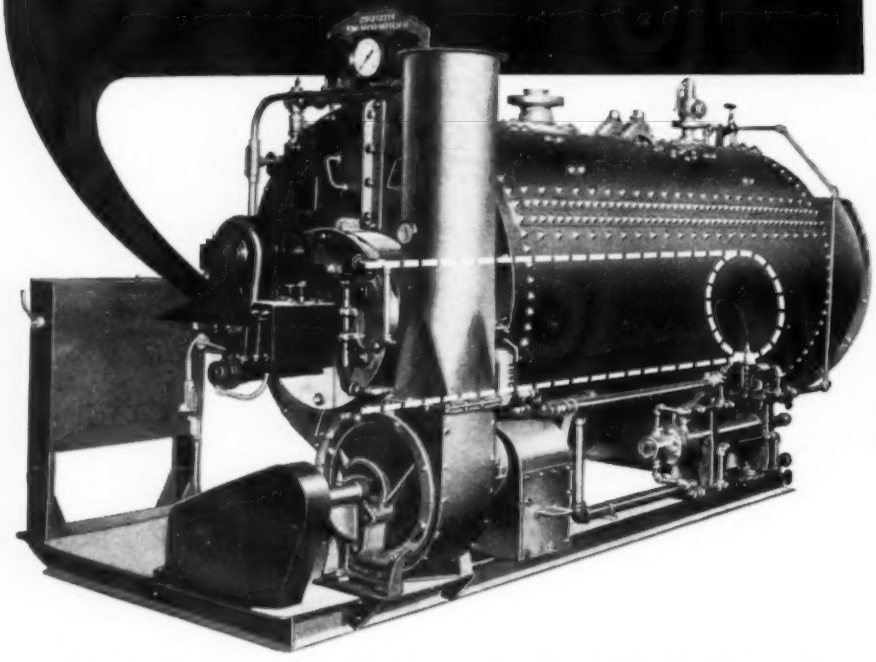
STEAM POWER PLANT EQUIPMENT

Complete Steam Generators • Type C 3-Drum Boilers • Type VL 2-Drum Boilers • The "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • Coal Pulverizers • Underfeed Stokers and Welded Pressure Vessels for the Process Industries.

ERIE CITY
SINCE 1840

ERIE CITY IRON WORKS • ERIE, PA.

Furnace Here Gives You EXTRA BENEFITS



Furnace relatively low in the drum saves you trouble because this location gives extra protection against damage due to low water—allows lower shell water level—and lessens liability of corrosion.

In addition to this "low-furnace" feature, the Preferred unit has both float and electrode type of low water cutoffs, thus affording triple protection against low water. As a result of this triple protection, no case has been reported of a Preferred furnace burning out. Because the furnace is below the point at which most of the steam bubbles form, it is in contact with water all the time . . . there's less possibility of corrosion from oxygen.

Shell water level is low, giving more steam releasing area. Additional steam dome capacity is gained. Foaming and water carryover are minimized. Delivery of dry steam is assured.

These features are examples of the careful planning Preferred combustion engineers have put into the design of the Preferred Unit Steam Generator. They are examples also of the benefits you will get when you replace your present boiler with a modern Preferred Unit. Write today for complete information.

PR-155

Additional Preferred Unit Steam Generator Features

1. Induced (pull-through) Draft—eliminates necessity of building expensive stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.

2. Fully Automatic Operation—even with Bunker C or No. 6 oil.

3. Preferred Oil Burner—exclusive aid to perfect combustion, built especially for this unit.

4. Four-pass, Down-Draft Gas Travel—results in maximum heat absorption.

5. 80% Minimum Thermal Efficiency—proved and guaranteed.

6. Full Range of Sizes—from 40 to 500 H.P. and pressures of 15 to 200 lbs. Two-pass Units in 20 and 30 H.P. and pressures of 15 or 125 lbs.

PREFERRED UTILITIES MANUFACTURING CORPORATION
1860 Broadway, New York 23, N. Y. P-11-47

PREFERRED UTILITIES

with Air Reduction on a consulting basis. Morrough P O'Brien has joined the engineering staff of Air Reduction. He is in charge of general and process engineering and has assumed direction of liquefaction research.

Elgin Softener Corp has appointed following representatives to handle industrial line of water-conditioning products: (1) Lamb Engrg Co, 530 N Charles St, Baltimore, for Md. and northern Va. (2) Midland Laundry Equipment Co, 2800 Lyndale Ave, S, Minneapolis, for Minn., N. D., S. D. and northwestern Wis. (3) James N Doyle, 2071 Glencoe St, Denver, for Colo. William De DeCourcy has reported to Pittsburgh office to take over his duties as industrial sales representative. He will cover western counties of Pa. with exception of Allegheny County, as well as part of W. Va. Harold M Messenger will cover part of N. C. and S. C. out of the Atlanta office.

Fred H Schaub Engrg Co announces appointment of A W Mortensen Co, 1004 S E Belmont St, Portland 14, Ore., as its representative in Ore. and northern Calif.

Hewitt rubber div, **Hewitt-Robins Inc,** has announced appointment of McJunkin Supply Co, Charleston, W. Va., as distributor of entire Hewitt line of industrial hose, belting and packing.

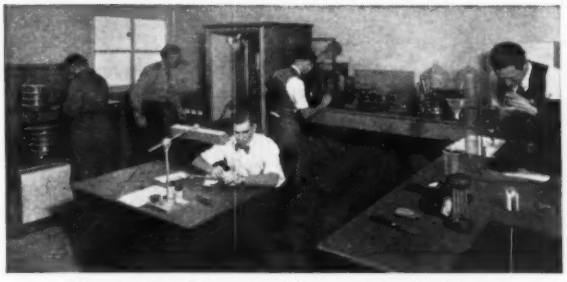
Fairbanks, Morse & Co has named L A Weom manager of pump div, replacing Arnold Brown, who has resigned.

E U Titus has been named Eastern sales manager of **Riley Stoker Corp.** He will be at the New York office.

All-State Welding Alloys Co has announced that distributors recently appointed for the All-State line of low-temperature welding and brazing alloys and fluxes include: (1) Post Welding Supply Co, Birmingham, Ala. (2) Oxygen Service & Supply Co, Santa Rosa, Calif. (3) M B Urquhart, Denver, Colo. (4) Alfred B King Co, New Haven, Conn. (5) Miami Welding Supply, Inc, Miami, Fla. (6) Calloway Brothers, Panama City, Fla. (7) General Auto Supply Co, Tampa, Fla. (8) Kenneth C Litz, Boise, Idaho (9) Benster Welding Supply Co, Chicago, Ill. (10) Bock Bros Welding Supply Co, Fort Dodge, Iowa (11) Barclay Co, Mason City, Iowa (12) Newkirk Sales Service Co, Waterloo, Iowa (13) Burnidge Welding Supplies, Pittsburg, Kan. (14) North-West Oxy-Acetylene Distributing Co, Wichita, Kan. (15) Louisiana Welding Supply Co, Baton Rouge, La. (16) Dillon's Welding Supply, Battle Creek, Mich. (17) Miller Welding Supply Co, Grand Rapids, Mich. (18) Muskegon Hardware Supply Co, Muskegon, Mich. (19) Saginaw Welding Supply, Saginaw, Mich. (20) Sierra Oxygen Co, Reno, Nev.

(21) Auto Gas Light & Appliance Co, North Bergen, N. J. (22) Welders Supply Co, Binghamton, N. Y. (23) Vance Boiler Works, Inc, Geneva, N. Y. (24) Randall Body & Welding Service, Herkimer, N. Y. (25) Walter Smith Battery & Welding Service, Kingston, N. Y. (26) Miller

What it takes to make a *better* dust collector



Thousands of dust particles are examined here

With the advent of pulverized coal as fuel for Power Plants, the efficiency required of dust collectors has steadily increased to a point considered unattainable ten years ago.

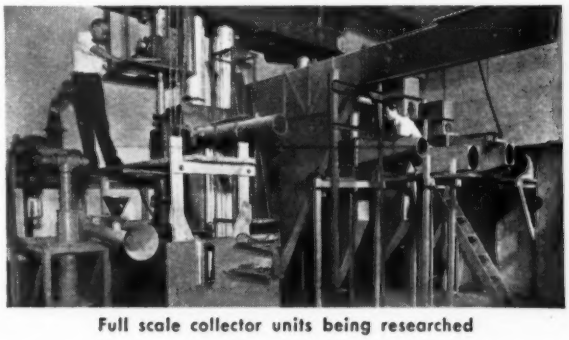
As far back as 1926, Prat-Daniel first applied the principle of centrifugal force to dust collection . . . a principle still used as the basis for the highly efficient Thermix collectors of today. Yet, today, with world-wide installations to their credit, Prat-Daniel still searches for better designs and developments in this important field.

The physio-chemical and testing laboratories, shown here, are only a part of the extensive research constantly carried on by Prat-Daniel, in an effort to find more efficient means of dust control.

One of the interesting sidelights of the testing laboratory is the use of full size collector elements for determining efficiency. This method provides an extremely accurate check, compared to the usual laboratory method of scale model testing. Obviously, results will be comparable to the final installation, composed of a greater number of such elements.

This continuous quest for the ultimate in dust control has paid dividends in placing Prat-Daniel as the leader in its field.

Our Project Engineers will be glad to show you how your plant operation can be improved by the use of more efficient equipment.



Full scale collector units being researched

Research points the way to better dust control

All inquiries should be directed to THE THERMIX CORP. PROJECT & SALES ENGINEERS
FIRST NATIONAL BANK BLDG., GREENWICH, CONN.
(Offices in 28 principal cities)

Equipment designed and manufactured by

PRAT-DANIEL CORPORATION

***Manufacturing Plant,* EAST PORT CHESTER, CONN.**

Economical POWER

can improve your PROFIT PERCENTAGE

Forward-looking industrialists and utility executives are seeking to hold the essential profit line in the face of rising labor and supply expense. They recognize improved plant efficiency as the principal factor in doing so. To obtain the maximum benefits offered by new developments, modern facilities and sound application ingenuity, management turns to experienced engineering counsel.

DESIGNING • ENGINEERING• CONSTRUCTION • PIPING

J. F. Pritchard and Company renders services to utility and industrial clients in all parts of the country, concerning every variety of problem relating to electric power and steam. This vast experience is brought to bear upon every undertaking of Pritchard's Power Division, whether it is a minor piping installation or a complete plant.

Complete Plants • Additions • Installations • Every detail geared to more profitable operation, at the lowest possible cost.

POWER DIVISION
FIDELITY BUILDING, KANSAS CITY 6, MISSOURI

J.F. Pritchard & Co.
ENGINEERS • CONSTRUCTORS • MANUFACTURERS
for the CHEMICAL, PETROLEUM, GAS & POWER industries

New York · Chicago · Houston · St. Louis · Tulsa · Pittsburgh · Dallas · Detroit
Omaha · Denver · Atlanta · St. Paul · Salt Lake City · El Paso · Mexico City

Welding Supply Co, New Hartford, N. Y. (27) Rene Neveu & Son, Plattsburg, N. Y. (28) National Welders Supply, Charlotte, N. C. (29) Carolina Welding Supplies, Inc, Raleigh, N. C. (30) Merritt-Holland Supply Co, Wilmington, N. C. (31) Welders Supply Co, Oklahoma City, Okla. (32) Independent Supply Co, Tulsa, Okla. (33) E R Joseph, Norristown, Pa. (34) Amarillo Supply Co, Amarillo, Tex. (35) Alamo Welding Supply Co, Austin, Tex. (36) Jess Bailey Co, Big Spring, Tex. (37) Car Parts Depot, Inc, El Paso, Tex. (38) Smithweld Co, Houston, Tex. (39) Alamo Welding Supply Co, San Antonio, Tex. (40) Acetylene Co of Utah, Salt Lake City, Utah. (41) W B Goode Co, Richmond, Va. (42) Spokane Oxygen Service, Spokane, Wash. (43) Samson Co, Clarksburg, W. Va. (44) Air Products, Inc. of West Virginia, Parkersburg, W. Va.

Black, Sivalls & Bryson, Inc, has set up a dept of market research and analysis under direction of Robert E Bingham of Kansas City.

G H Niemeyer, president of Handy & Harman, Harry E Radix, president, and Thomas G McMahon, secretary-treasurer of Thomas J Dee & Co, have announced that their two concerns have joined forces. Thomas J Dee & Co will become the Dee div of **Handy & Harman** and will continue to function under Harry E Radix and Thomas G McMahon and the present plant executives and personnel. It will maintain the present downtown Chicago office in the Pittsfield Bldg, 55 E Washington St. Handy & Harman's Chicago office will move from 20 N Wacker Dr to Dee div plant at 1900 W Kinzie St.

R. I. Insulated Wire Co, Providence, R. I., has appointed Marwood, Ltd, of San Francisco, as Pacific Coast managers for its complete wire and cable line. Ellman & Zuckerman, of Chicago, has been named representative in that territory to handle its flexible cords line. Crescent Electric Sales Co, of Chicago, will be retained to handle the asbestos insulated-wire products.

Troy T Alverson has been made assistant manager of dust and fume control div of **American Wheelabrator & Equipment Corp,** Mishawaka, Ind. Fred E Uhl has been made district sales representative, succeeding Alverson, with offices in Baltimore, Md.

B & M Mfg Co, with general offices at 19 N Harrison St, East Orange, N. J., has recently been formed by Wiley W McMinn and Olof Brant. The company's factory at 1825 Monroe Ave, Grand Rapids, Mich., will manufacture spirally formed tubular products under trade name of **Spiralock.**

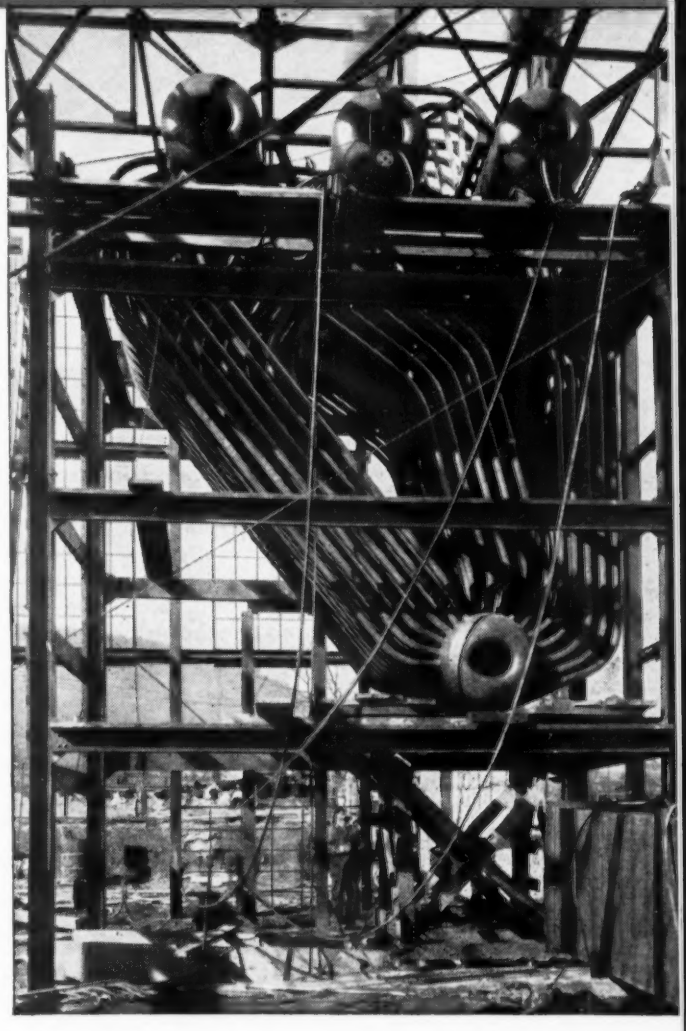
United States Rubber Co has appointed William M Dougherty assistant to the president, Herbert E Smith. Dougherty will remain an assistant secretary of the corp. H Barden Allison has been made sales manager of Gilmer div in Philadelphia. Ralph W Stambaugh has been made district sales manager of mechanical goods in Cincinnati district. Other personnel changes in the mechanical goods sales

DOWELL

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

Remove Mill Scale

THE CHEMICAL WAY!



CHEMICAL CLEANING SERVICE PROTECTS NEW BOILERS!

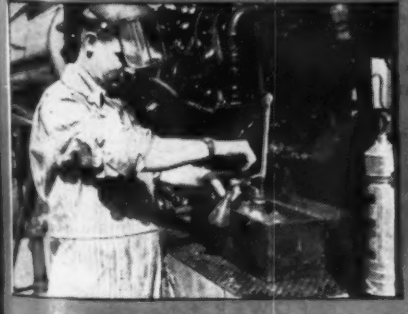
Many power engineers have found that the Dowell chemical method of removing mill scale from new boilers before the first firing results in more satisfactory boiler operation.

Dowell engineers fill the new boiler with specially selected liquid solvents designed to dissolve the mill scale. Unless removed, mill scale may retard heat transfer, slough off particles which abrade the system during operation, and act as a base for further corrosion. Dowell brings all necessary chemicals to the job in truck-mounted tanks and furnishes pumps, mixers, heaters and control equipment.

The chemical removal of mill scale *after* equipment erection can eliminate much of the extra care required in the handling of previously sand-blasted or pickled tubes. It may also substitute satisfactorily for the grease-removing alkaline pre-boil. Call or write Dowell for an estimate of the cost of Chemical Scale Removal Service for your heat exchange equipment.

DOWELL INCORPORATED • TULSA 3, OKLAHOMA

New York, Philadelphia, Boston, Baltimore, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis, Kansas City, Wichita, Oklahoma City, Houston, Fort Worth, Shreveport, Mt. Pleasant, Michigan; Salem, Ill.; Borger, Texas; Wichita Falls, Texas; Midland, Texas; Lafayette, La.; Long Beach, Casper: Dowell Associate—International Cementers, Inc.



Dowell service is supervised by trained engineers using carefully selected liquid solvents and special mobile equipment.

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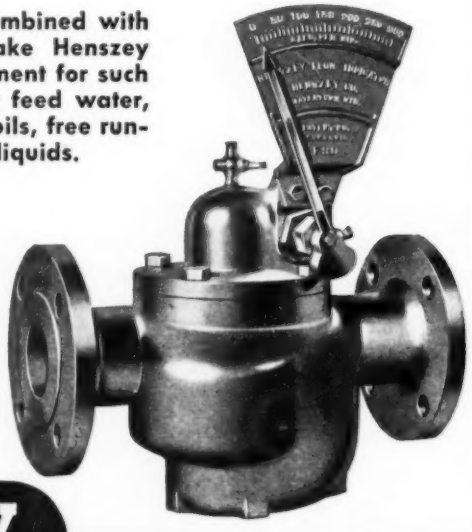
Accurately *Indicates* ANY FLOW ZERO TO 100 PER CENT

HENSZEY *Flow* INDICATOR

Henszey Flow Indicators respond immediately as soon as any free-flowing fluid passes through. They instantly and accurately register the rate of flow from zero to 100 percent and tend to indicate pulsating flow exactly as it occurs. Graduations on the dial are uniformly spaced and read direct. Only three moving parts assure accuracy and eliminate breakdowns due to complicated gears and mechanisms. Installation is simple — directly in the pipe line without additional supports.

Features such as these—combined with rugged construction — make Henszey Flow Indicators ideal equipment for such diversified liquids as boiler feed water, condensate, gasoline, light oils, free running chemicals, and other liquids.



If yours is a tough flow measuring problem, consider Henszey Flow Indicators.

Send for Bulletin FI-1

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FLOW INDICATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
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also MILK EVAPORATORS and PRE-HEATERS

organization are as follows: (1) Purdy Miller has been appointed district sales manager in Indianapolis. (2) N W Swenson has been named district sales manager in Buffalo. (3) Paul S Bigby has been made district sales manager at Milwaukee.

H Hugh Willis has been named director of research and development of the **Kellex Corp,** atomic-energy subsidiary of M W Kellogg Co.

Harry Y McCool Sr, superintendent of maintenance of steel and tube div of **Timken Roller Bearing Co,** retired Sept 1 after more than 31 years of service. Leland S Steiner has been named as McCool's successor.

T J Cope, Inc, announces appointment of Charles E Adams as its agent covering western Pa. and W. Va. territories. Adams will handle the complete Cope line from his offices at 208 Kirby Bldg., Pittsburgh, Pa.

Charles S Hoehn has announced his retirement as president of **Enterprise Engine and Foundry Co,** San Francisco. While his retirement will relieve him of active duties as head of the company, Hoehn will continue to serve on the board of directors and in a special consulting capacity.

Pittsburgh Consolidation Coal Co has announced additional appointments to staff of research and development div: (1) R V Safford will be in charge of coal gasification pilot plant at Library, Pa. (2) Thomas G Reynolds has been made chemical engineer on coal gasification. Reynolds and Safford are both assigned to development dept under W D McElroy, manager. (3) J Hunter Johnston has been named control supervisor in charge of accounting and purchasing sections in the service dept, headed by Gerard C Gambs. (4) Warren R Eakin has been made economist in the service dept.

Arnold J Mackowsky has been appointed district manager for electric appliance sales of **Yale & Towne Mfg Co.** The sales territory assigned to Mackowsky includes Me., Vt., N. H., Mass. and R. I.

American District Steam Co has named Equipment, Inc, 35 Westminister St, Providence, R. I., as district representatives for R. I. and southeastern Mass.

George E Gregory has resigned as vice-president of Owens-Corning Fiberglas Corp of Toledo to organize a new company, **Morton-Gregory Co,** to manufacture and sell new industrial and consumer products incorporating Fiberglas yarns and other materials. The new products were developed by a group headed by Henry J Morton, consulting electrical engineer and president of H J Morton Associates, Inc.

Carleton Shugg has been named manager of Hanford directed operations of **United States Atomic Energy Commission,** with offices at Richland, Wash. Dr Bruce S Old has been appointed consultant to Atomic Energy Commission, div of re-

REEVES Sales & Service Representatives — from Coast to Coast!

California
Western Gear Works, Lynwood
Pacific Gear & Tool Works, San Francisco 3

Colorado
R. F. Hamilton & Associates, Denver 2

Florida
H. C. Flanagan, Tampa 1

Georgia
Reeves Pulley Co., Atlanta

Illinois
Reeves Pulley Co., Chicago 6

Indiana
A. R. Young, Indianapolis 4

Kentucky
Alfred Halliday, Louisville 2

Louisiana
F. N. Johnston, Inc., New Orleans 12

Maryland
Carey Mchy. & Supply Co., Baltimore 2

Massachusetts
Reeves Pulley Co., Cambridge 42

Michigan
Reeves Pulley Co., Detroit 11

Minnesota
R. X. Raymond Co., Minneapolis 3

Missouri
W. C. Carolan Co., Kansas City 6
Bates Sales Co., St. Louis 1

New York
Reeves Pulley Co. of N. Y., Inc., New York 7
Potter & Dugan, Inc., Buffalo 2
Potter & Dugan, Inc., Rochester 4
Potter & Dugan, Inc., Syracuse 2

North Carolina
M. R. Snyder Co., Charlotte 2

Ohio
Reeves Pulley Co., Cleveland 3
John T. Young, Cincinnati 23

Oklahoma
Ward R. McGavren Co., Oklahoma City 7

Oregon
C. W. Harshberger, Portland 4

Pennsylvania
Reeves Pulley Co., Philadelphia 4
W. G. Kerr Co., Pittsburgh 22

Rhode Island
Machine Parts Corp., Providence

South Carolina
J. W. Vaughan Co., Greenville

Tennessee
Riechman-Crosby Co., Memphis 1

Texas
Geo. J. Fix Co., Dallas 1
Brance-Krachy Co., Inc., Houston 1

Utah
James Q. Leavitt Co., Ogden

Virginia
Asa A. Tuttle, Norfolk 1
Smith-Courtney Co., Richmond 11

Washington
Western Gear Works, Seattle 4

West Virginia
E. W. Smith, St. Albans

Wisconsin
Parsons-Caro Co., Milwaukee 2

CANADA

Ontario
Peerless Engineering Sales, Ltd., Toronto 4

REEVES is also represented by speed control specialists in 18 foreign countries.

It Pays to Know Your REEVES Speed Control Engineer

In more than 260,000 widely diversified industrial installations covering some 25,000 plants—and as standard equipment on more than 2,100 different makes of machines—REEVES Speed Control is providing the infinite, accurate speed adjustability which assures increased output, improved, uniform quality and lower manufacturing costs.

Sharing the credit for this enviable record—along with the men who design and build REEVES Variable Speed Drives—is a third group of men. These are the men whose reponsibility it is to see that every REEVES application is correctly engineered, installed and serviced—REEVES Speed Control Engineers.

Realizing that its obligation to users of REEVES-equipped machines does not end with the closing of the sale, but continues throughout the operating lifetime of the equipment, REEVES today maintains a nation-wide organization of these *specialists in the specialized field of speed control engineering.* Check the list at the left for the name of the REEVES representative nearest you. Feel free to consult him, without obligation, on any speed control problem relating to the machines you build or operate. He's a valuable man to know because he knows his business.

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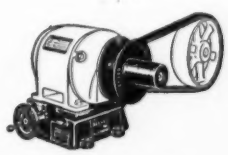
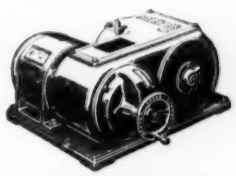
Recognized Leader in the Specialized Field of Speed Control Engineering

THE THREE BASIC REEVES SPEED CONTROL UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.

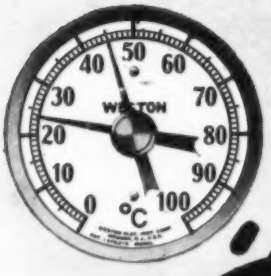


VARI-SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 15 hp.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 hp.

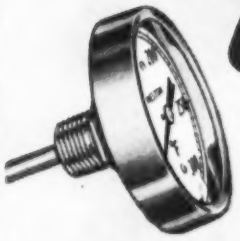
Accurate Variable
REEVES Speed Control
Gives the Right Speed for Every Job!



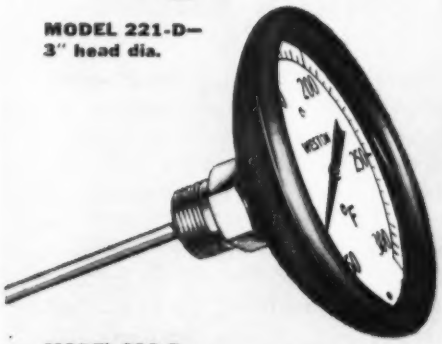
MAX-MIN MODEL—
Shows high or low temperatures reached since last setting

it's Weston

IN TEMPERATURE MEASUREMENT, TOO!

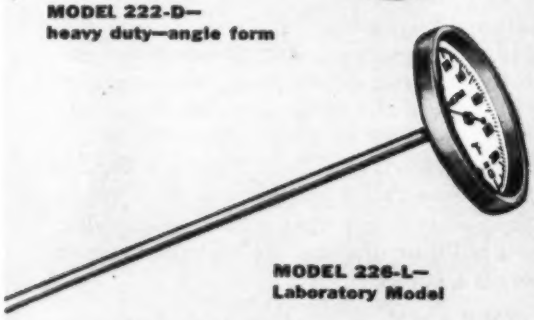


MODEL 221-D—
3" head dia.



MODEL 222-D—
heavy duty—angle form

MODEL 122-D—
heavy duty—
straight form



MODEL 226-L—
Laboratory Model

In temperature measurement, too, WESTON leads the way! The sturdy, all-metal construction of these WESTON thermometers, plus their simplicity of design, materially reduces thermometer breakage and maintenance, and safeguards their high initial accuracy over long periods of time. Available in sizes, types and stem lengths for most applications. For information on the complete line see your jobber, or local WESTON representative. Weston Electrical Instrument Corporation, 617 Frelinghuysen Ave., Newark 5, N. J.

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search, in capacity of chief metallurgist. Dr Old continues his present work with Arthur D Little, Inc, Cambridge, Mass., and serves Atomic Energy Commission on a part-time leave of absence from Arthur D Little, Inc. He will assist in organizing work of the commission in the metallurgical field.

Harbison-Walker Refractories Co has purchased **Louthan Mfg Co,** E Liverpool, Ohio. Charles W Gerster has been made general manager of Louthan.

Nelson J Leonard has been placed in charge of the Elwell-Parker trucks, tractors and cranes account for **Colby Steel & Engrg Co,** Seattle, Wash.

Mississippi Power & Light Co has named Ray W Braswell operating and engineering manager. Braswell will be in charge of operating, engineering construction and maintenance of all physical property. Jere F Harrison has been made engineering consultant.

N Hawthorne Hawkins Jr has been appointed vice-president in charge of operations of **Birmingham Electric Co.** J M Reynolds has been made assistant to the president. H G Ford Jr has been elected manager of transportation.

H F Faulkner has resigned from his **Seattle City Light** position as resident engineer at Ross Dam. Charles E Shevling replaces him.

Arthur D Little, Inc, Cambridge, Mass. has announced several additions to its technical staff: Russell J Bowen, Robert W Fabian, William V Keary, Benjamin A Lambert, Albert E Mingnone, George E Richter, Richard W Tindal and Elizabeth Thorogood.

Richard Mack has been appointed as a member of **Florida Railroad and Public Utilities Commission,** succeeding the late W B Douglass.

Water R McDonald, who was recently elected president of National Association of Railroad and Utilities Commissioners, has been re-elected for the sixth consecutive 2-year term as chairman of **Georgia Public Service Commission.** At the same time Matt L McWhorter was re-elected vice-chairman of the Georgia Commission.

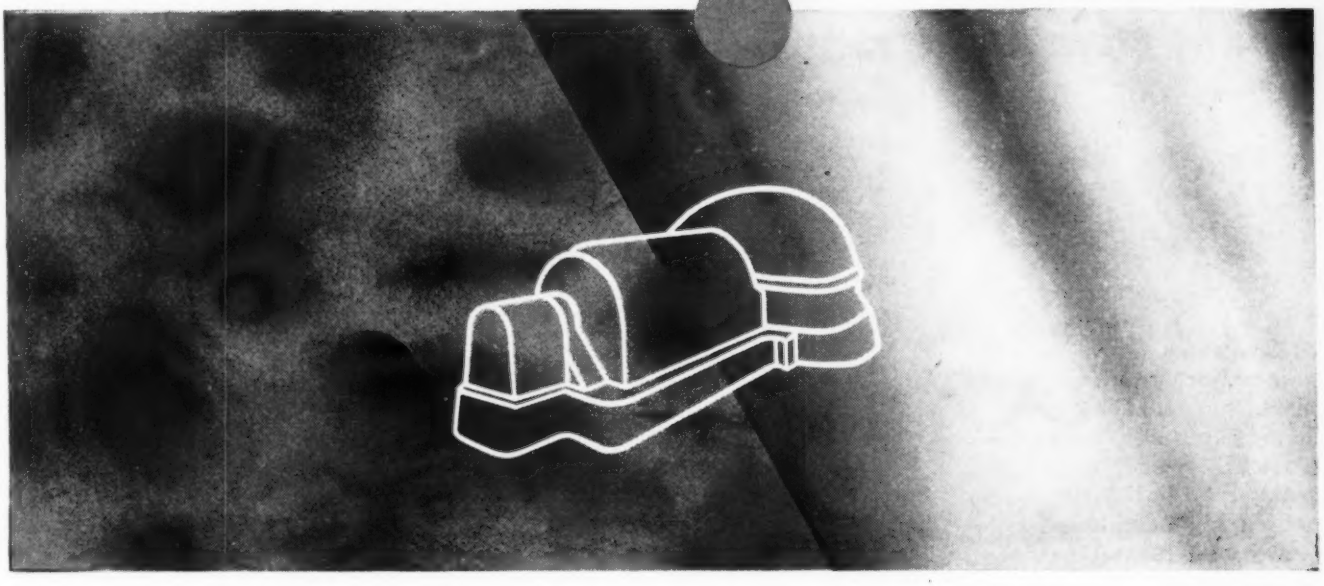
Lead Industries Assn, 420 Lexington Ave, New York 17, N. Y., has named Christy J Vander Valk as technical director of its red lead div. His duties include coordination of research program on metal protective paints and technical service to users and specifiers of red lead.

American Welding Society has elected Joseph Gordon Magrath for the new position of executive secretary.

Battelle Memorial Institute has made six veteran members of the staff assistant directors: Dr Frank C Croxton, Dr Clarence H Lorig, Dr Howard W Russell, Ralph A Sherman, Clarence E Sims and

A vital consideration in turbine oil selection

WILL IT PREVENT RUST?



GULFCREST OIL WCR

prevents rust on all oil bathed surfaces

THE inevitable presence of water in every turbine system makes rust prevention a major consideration in turbine operation. You get effective help on this problem when you select an oil with rust preventive properties—when you select Gulfcrest Oil WCR.

How does Gulfcrest Oil WCR prevent rust in turbine systems? Because it contains a permanent, effective corrosion inhibitor! This additive has preferential wetting characteristics—prevents water from contacting metallic surfaces. A development of Gulf technologists, this additive is insoluble in water, is not used up and as a result gives long term protection against rust.

Another important reason why Gulfcrest Oil is the logical choice for your turbine! Alchlor processed, rust inhibited, Gulfcrest is the world's finest turbine oil. Send the coupon at right for booklet which gives you complete facts on this superior oil.

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—CUTS UP-THE-STACK HEAT LOSS UP TO 20%

Ranarex — the mechanical indicator and recorder of the CO_2 content of flue gases—saves up to 20% on up-the-stack heat loss! Useful for *any* type boiler, furnace, oven, kiln or still fired with *any* type fuel. Ranarex is rugged, containing no chemical or fragile parts . . . it's accurate to within 3/10 of 1%. For the *most efficient* combustion—use Ranarex!

FREE BOOKLET

of the many uses and advantages of Ranarex will be sent you on request. Write The Permutit Co., Dept. P-11, 330 West 42nd St., New York 18, N.Y., or The Permutit Co. of Canada, Ltd., Montreal.

RANAREX

PRODUCT OF PERMUTIT

John D Sullivan. The new assistant directors will share with Director Clyde Williams and Assistant Director Oscar E Harder in the technical direction of Battelle research.

Oak Ridge Chapter of **National Assn of Power Engineers** has been organized with the following officers elected and installed: (1) C T Bolen, president (2) W T Childress, vice-president (3) C H Yoho, corresponding secretary (4) L G Domer, financial secretary (5) R E Mount, treasurer.

Titus G LeClair, chief staff engineer of Commonwealth Edison Co and past president of Western Society of Engineers, has been elected chairman of **Washington Award Commission** for the year 1947–1948.

Joseph Modrovsky has become a member of the faculty of **Polytechnic Institute of Brooklyn** as an assistant professor in dept of mechanical engineering with the beginning of the 1947–1948 academic year.

A new corporation devoted to consultation, research and development in field of powder metallurgy, **Sintercast Corp of America,** New York City, has been formed by Erwin Loewy, president of Hydropress, Inc, and two associates, Dr Claus G Goetzel and John Ellis. Loewy is president of the new group, Goetzel vice-president and director of research, and Ellis chief engineer.

Harry W Smith Inc has been appointed to handle the technical public relations job for Sintercast Corp of America.

Charles F Steiger has joined staff of **Douglas M McBean, Inc,** consulting engineers. An office has been opened at 61 W 56th St, New York 19, N. Y. Messrs Douglas McBean, Robert Hall and Carl Lamb will divide their time between the main Rochester and the newly opened New York City offices.

Heath Co, engineers and exporters, has been formed for export of technical materials and equipment. The new organization, with offices at 150 Broadway, New York City, will offer to foreign purchasers complete engineering services in procurement of machine tools, power generation, conversion and transmission equipment.

OBITUARIES

Boyd Coe Dennison, 66, professor of electrical engineering at Carnegie Institute of Technology, died at Pittsburgh on Aug. 19.

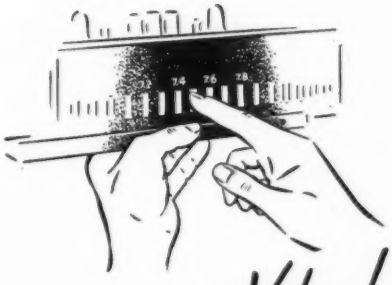
George A Elz, 51, head of electrical operation at Edgar generating station of Boston Edison Co, died suddenly at Belgrade Lakes, Me., on Aug. 18.

Edward W Nichols, 58, a stationary engineer for the last 15 years at Buffalo Belting & Weaving Co, died at his home in Buffalo recently after an illness of four years.

Phillip A Jerguson, 74, founder and for 41 years president of Jerguson Gage & Valve Co, Somerville, Mass., died at Capi-

Taylor Comparators

Simplify BOILER WATER TESTING!



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***You** get Speed* . . . with a simple, three-step operation!

***You** get Simplicity* . . . no handling of fragile Nessler tubes!

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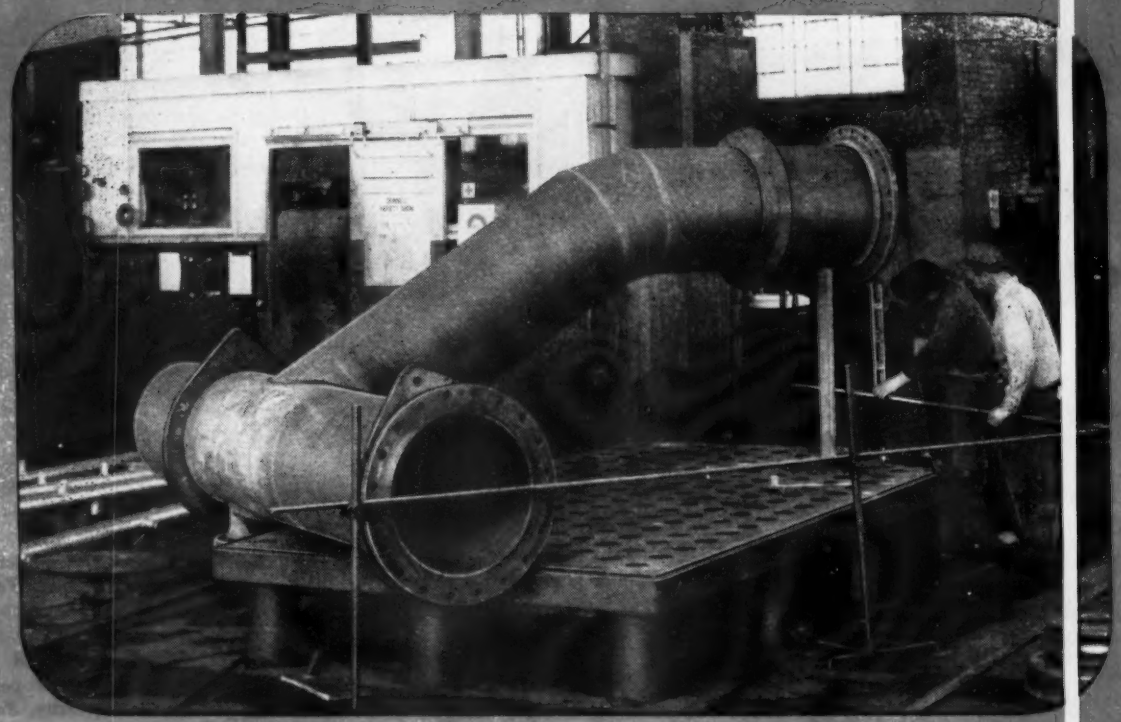
MODERN PRESSURE PIPING REQUIRES SPECIALIZED SHOP FACILITIES AND PERSONNEL

CHECKING ALIGNMENT in Qualified Pipe Shops *SAVES TIME* in the Field



Misalignment and dimensional variation in piping subassemblies on the job can cause much trouble and expense . . . waste much time in field erection . . . and may cause excessive stresses if not corrected.

Qualified pipe fabricators take no chances in this important matter. Each subassembly is checked for alignment and dimensional correctness with utmost care by men who are specialists in this work. As a result, such assemblies are erected with minimum time and effort. This is just one of the many services which the qualified pipe fabricator offers you.

Piping from a qualified fabricator is delivered to the job in a series of subassemblies ready to erect. All difficult operations have been performed . . . the subassemblies are commercially practical, correctly aligned, heat treated and stress relieved where necessary, thoroughly cleaned, shop tested and inspected. Piping pre-fabricated by a qualified fabricator is better piping . . . it saves money, time and trouble.

Write for Technical Bulletin describing pressure piping fabrication

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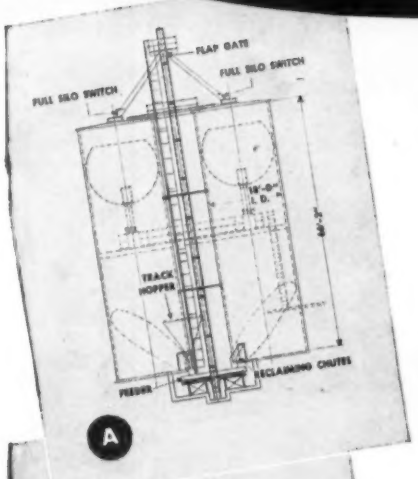

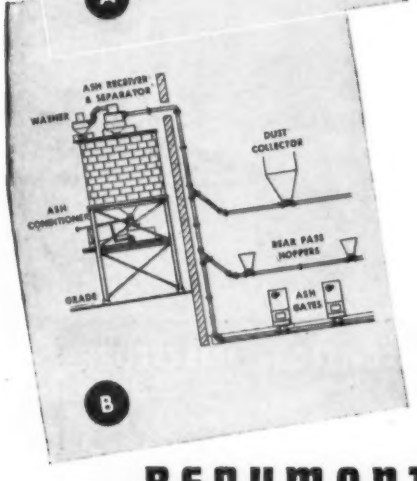

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The Beaumont "Vac-Veyor" system offers the most direct and economical method for removal of ashes, siftings, soot and dust. They are vacuum conveyed through a pipe from their source to an ash receiver and separator—then into the silo where they remain until final disposal.

Beaumont engineers design and erect this equipment—a complete coal and ash handling system. This brings you savings in installation as well as in handling costs—you have one contract, we have sole responsibility.

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tal Island, Me., on Aug 19. He retired from this post in 1945 when the company was sold. At the time of his death he was president of the First National Bank, Medford, Mass.

Joseph Emory Sirrine, 75, founder and senior partner of J E Sirrine & Co, an engineering firm of Greenville, S. C., died on Aug 8.

Arthur F Kassing, 80, stationary-engineer, died recently in Utica, N. Y. He had formerly been associated with Robert Fraser Dept Store in Utica.

Percy Jenkins, 47, hardware products sales manager of Wickwire Spencer Steel Div of Colorado Fuel & Iron Corp, New York, N. Y., died suddenly on Aug 20.

W B Douglass, chairman of Florida State Railroad and Public Utilities Commission, died of a heart attack Aug 4. He would have been 62 years old on Aug 7.

Richard D Sappington, 55, superintendent of maintenance of Niagara Falls Power Co and an employe of the firm for more than 30 years, died recently in a Philadelphia hospital after a long illness.

Ernest William Rudd, 64, a stationary engineer at North American Cyanamid plant in Niagara Falls, Ont., died recently at his home there following a brief illness. He was a member of the Stationary Engineers' Institute of Ontario.

Earle W McMullen, 60, director of research for Eagle-Picher Co and prominent in engineering chemistry, died at Mt Carmel Hospital in Pittsburg, Kan., on Aug 26.

Norman H Coit, 52, chairman of the board of South Carolina Electric & Gas Co, died Sept 3 in Philadelphia following an illness of three weeks.

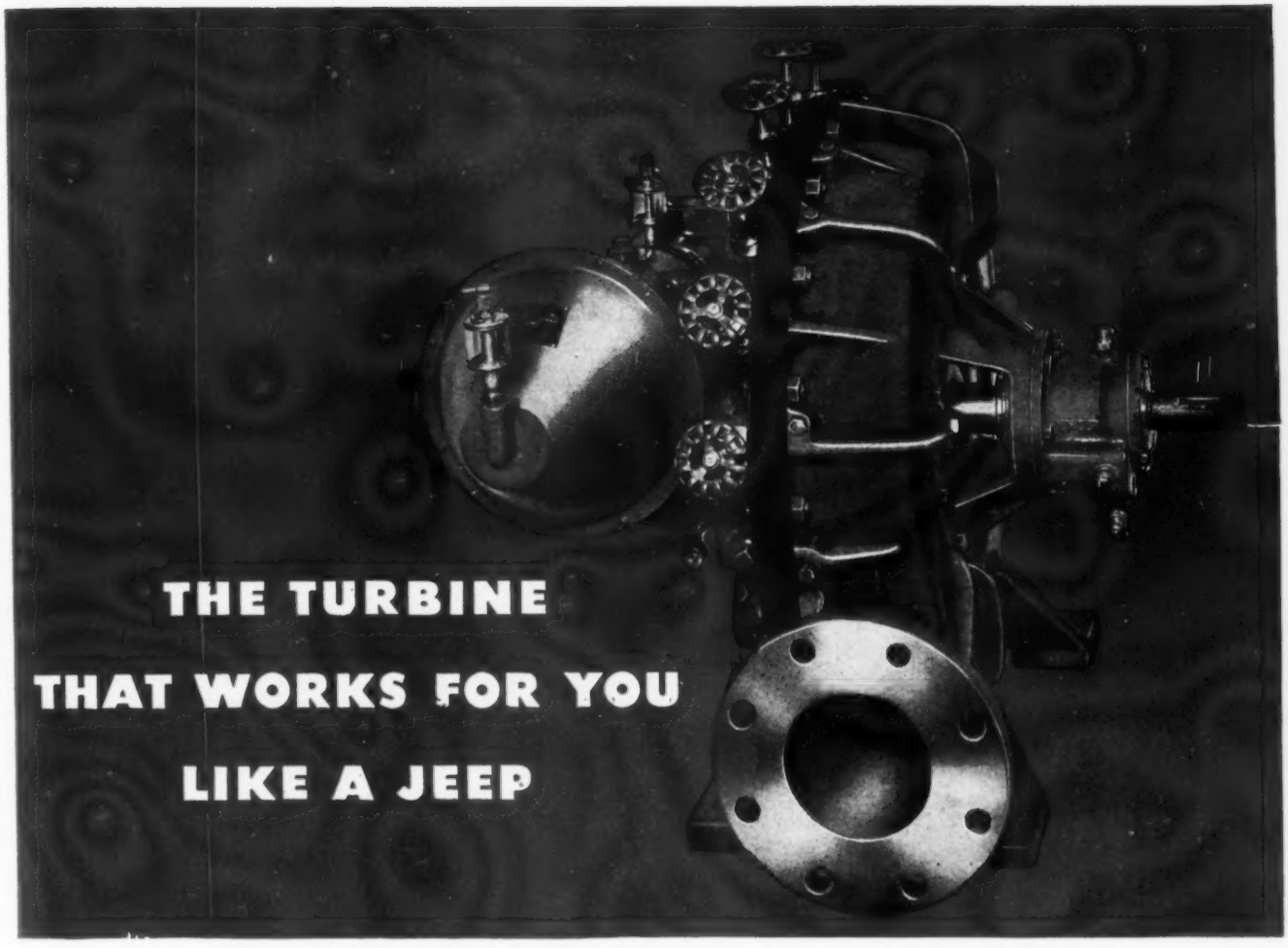
Stephen V Collins, 70, stationary engineer, died recently at Niagara Falls, N. Y. He had been employed by the city and formerly by Spray Brewing Co.

Frank Oakes Ellenwood, 68, John Edson Sweet professor of heat-power engineering at Cornell University, died Sept 8 at Strong Memorial Hospital in Rochester.

Benjamin R Foote, 61, research engineer for Hartford Electric Light Co, died at Hartford, Conn., on Aug 27.

Secretary of State George C Marshall has accepted honorary membership in American Society of Mechanical Engineers. In a letter to Eugene W O'Brien, president of ASME, Marshall said that he planned to accept the honor in person, if possible, at the society's annual dinner Dec 3 in Atlantic City. O'Brien said that Henry Ford II, president of Ford Motor Co, would be a speaker at the dinner, tentatively scheduling a talk on "Great Production for Peace." The ASME is holding its 68th annual meeting on Dec 1-5.

Rapid progress is being made on the Ohio Public Service Company's $40,000,000 5-year construction program begun last year. New installations and improvements in the generating stations at Lorain, Warren, Mansfield, the R R Burger station on the Ohio River near Bellaire, Ohio, are progressing satisfactorily.



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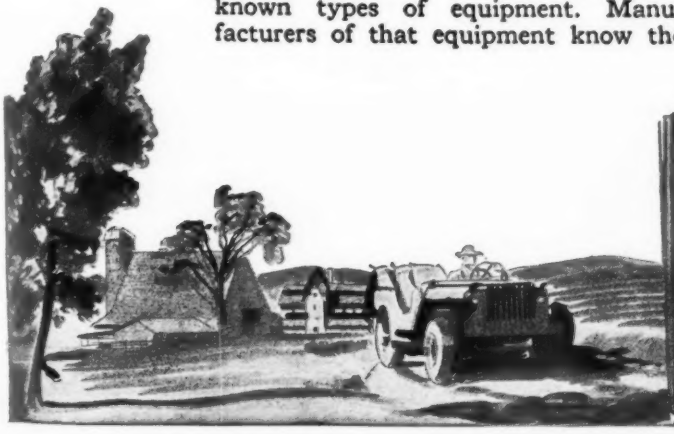
The Coppus line of "Blue Ribbon" turbines runs from 150 HP down to fractional — there are six frame sizes, and prices are in proportion. You can match a Coppus turbine to the job, saving the money you might otherwise spend for a turbine that's larger than necessary.

You'll see Coppus "Blue Ribbon" Steam Turbines on many nationally-known types of equipment. Manufacturers of that equipment know the quality that is represented by the Coppus "Blue Ribbon" — more than 85% of all orders since 1937 has been repeat business.

Select the right size of Coppus turbine for any job that calls for "jeep duty". Like all Coppus "Blue Ribbon" products (blowers, ventilators, gas burners, etc.), they are made to extremely close tolerances with accuracy controlled by Johansson size blanks. Before shipment, every turbine is dynamometer-tested.

Write for Bulletin 135-10. Coppus Engineering Corp., 171 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in SWEET'S.



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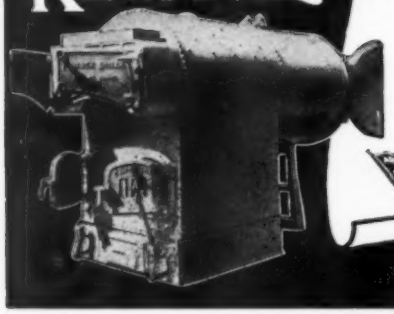
Extra STRENGTH for Heavy Duty

KEWANEE



● Backed by more than 75 years of boiler building experience Kewanee Heavy Duty types have all the characteristics which make firebox boilers ideal for high pressure.

10 to 304 H.P.

100, 125, 150 lbs. W. P.

Built of steel with extra stout stays and braces to add further strength.

For 6" Scale with pipe diameter markings . . . WRITE Dept. 96-K11

KEWANEE BOILER CORPORATION

KEWANEE, ILLINOIS

Division of AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

TO HELP YOU WITH FUTURE POWER PLANNING

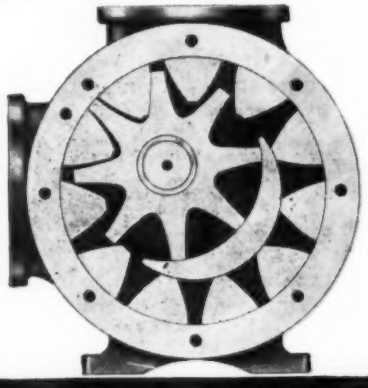
Special section on

POWER-TRANSMISSION CLUTCHES

FEBRUARY—POWER

16 pages summarizing the latest developments in this field.

Here's a Worker!



VIKING ROTARY PUMPS

The pump that does the job well, day in and day out, is the one that's a worker. The Viking, with its "Gear Within a Gear—2 moving parts" principle, gives this type of service. Its rugged construction, without small intricate parts, springs, gadgets, etc., gives it the long, dependable life expected of a good pump.

Viking rotary pumps are engineered for the job—to do the work assigned them. Ask for free folder 47SW today. Recommendations gladly given without obligation.

VIKING PUMPS — VIKING PUMP CO. CEDAR FALLS IOWA

See Our Catalog In SWEETS

Viking PUMP COMPANY Cedar Falls, Iowa

A STORY OF TWO ENGINEERS

●

Both have a Packing Problem!

Engineer Jones thought his packing problem was different . . . and knew it when his local packing supplier indicated not one but five separate installations to complete his job. His wry, troubled frown tells us he's looking for a simpler answer.

Engineer Smith knew his ABC's. No wonder he's smiling. One swift glance at his Palmetto Packing Selection chart solved his different packing job in a jiffy. Now he's free to tackle his bigger. more important duties.

●

MORAL: There is not one type of Palmetto Packing *for each* installation . . . There are only a *few types* of Palmetto Packings . . . and they cover *all applications*. Specify Palmetto . . . the Simple, yet Complete line. Write for your Palmetto A-B-C Packing Selection Chart today. It's simple as A-B-C.

PALMETTO Packings

"There is a Palmetto Packing Distributor Near You."

GREENE, TWEED & CO.

NORTH WALES, PENNSYLVANIA

AMERICAN BOX BOARD COMPANY

FOLDING PAPER BOXES
FIBRE SHIPPING CONTAINERS
CORRUGATED SHIPPING CONTAINERS

STRAW BOARD
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HIGH TEST LINERS AND CHIP

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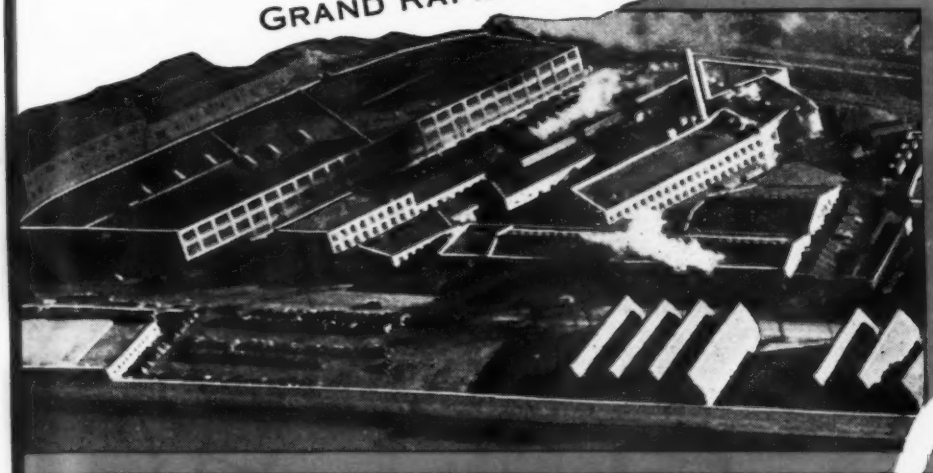
REPORTS OVER 86% EFFICIENCY



DETROIT ROTOGRATE STOKER

Repeats

First Detroit RotoGrate Stoker Installed in 1942 American Box Board Company, Grand Rapids, Mich.

ANOTHER DETROIT ROTOGRATE STOKER

merican Box Board Company, manu-cturers of container board and con-ners, have used a RotoGrate Stoker plied to a steam generator since 42. The rated capacity is 110,000 unds of steam per hour. Another der now calls for an additional Roto-Grate Stoker for a new 75,000 pound unit.

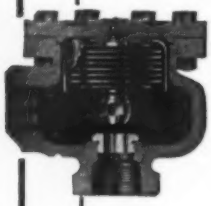
Detroit RotoGrate permits high burning rates with fuels of either high or low ash content. *Continuous Cleaning—Forward Moving Grate* Spreader Stoker—it quickly responds to load changes.

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

District Offices in Principal Cities — Works at Monroe, Michigan

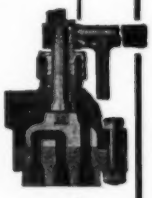
WHY MAINTENANCE MEN REPORT

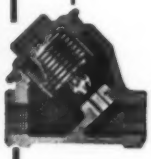


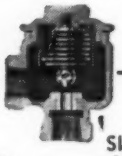
Standardizing on

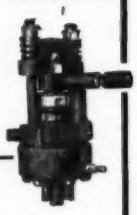
NICHOLSON VALVES & TRAPS

Pays Off









The universal order to "cut inventory of spare parts" spells standardization. Here are fundamental reasons why an increasing percentage of plants are standardizing on Nicholson steam traps and cylinder control valves.

SIMPLICITY — Maximum freedom from trouble and ease of repair.
RUGGEDNESS—Withstand unavoidable abuse.
COMPLETE LINE — Solves supply problems.
CONVENIENT SERVICE on specification and maintenance problems.

SEE OUR CATALOG IN SWEET'S

Send for catalogs 444 and 546 or . . .

Let us furnish you specific engineering details of Nicholson units as applied to your needs

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Manufacturers of Steam Specialties for Over Three-Quarters of a Century

D. W. HAERING & CO., Inc.

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That's just exactly what the man said.

You've probably said it, too — as you leafed through the advertising pages of a current issue of THIS magazine.

It happens all the time — to every man who is on top of his job.

Why? Because he keeps a weather eye out for the things that promise a better, faster, more economical way of doing something.

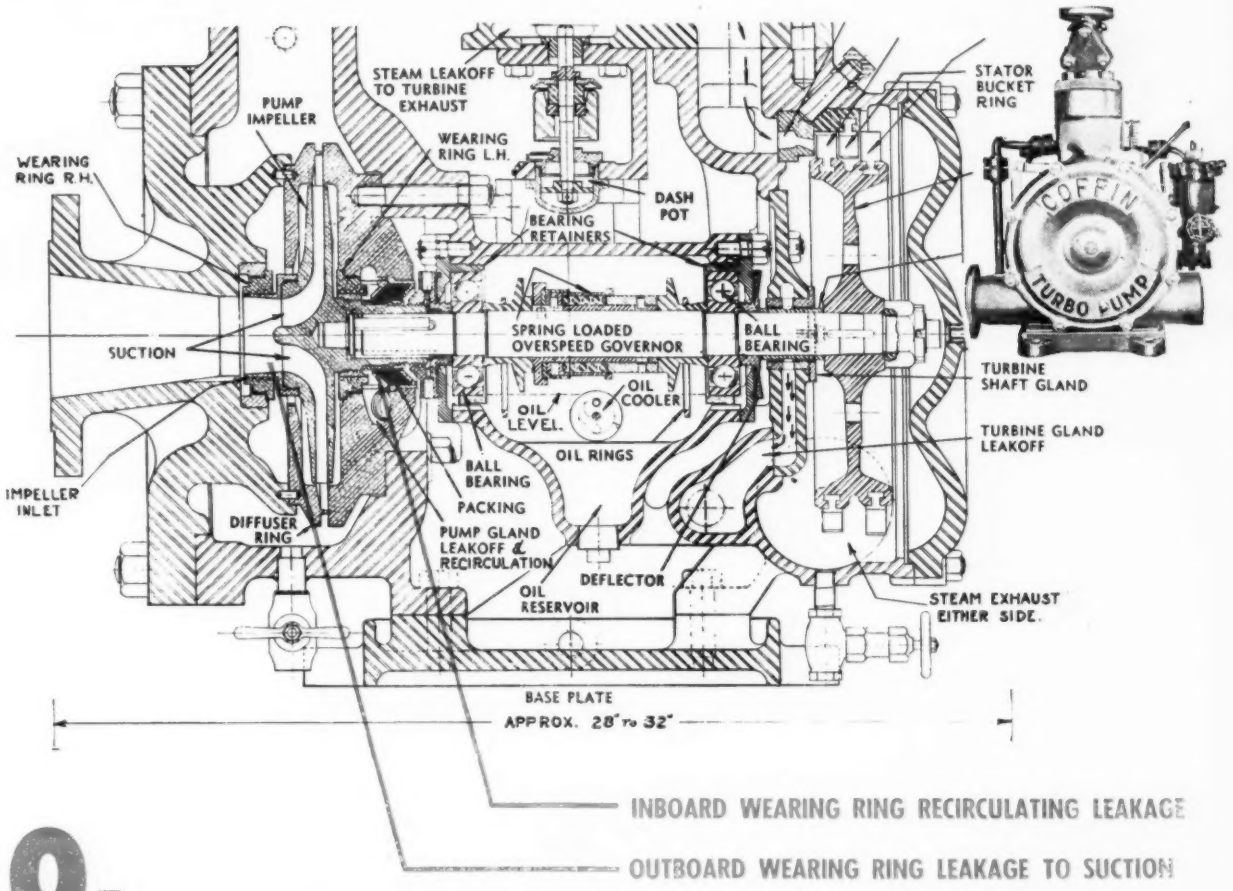
He knows that America's leading manufacturers take the newest and best of their products and services to market in the advertising pages of the business and industrial magazines that help him keep on top of his job. And if *it's for him* he wants to know what makes it tick.

To keep in touch with the parade - - - - - -

READ THE ADS.

COFFIN TURBO PUMPS

HIGH SPEED • SINGLE STAGE



9- Integral Recirculation System

The essential leakage past the inboard wearing rings is piped back to the suction reservoir (feed tank). Thus excessive pressure is not imposed on the pump gland and the recirculation effected is sufficient to permit operation without overheating or "flashing" for indefinite periods with the pump discharge shut off. Extra load on the pump and automatic or manual recirculating valves are eliminated.

Standardized Boiler Feed Units for:

Steam Pressures to 650 PSI
Steam Temperatures to 850 F
Back Pressures to 60 PSI

Pump Capacities to 500 GPM
Discharge Pressures to 750 PSI (Heads to 1800 feet)
Liquid Temperatures to 300 F

UNIQUE FEATURES

1. Standardized Steam Turbine Centrifugal Pump and Governor Sets, individually engineered, assembled, and tested . . . for IMMEDIATE SHIPMENT.
2. No destructive casing erosion-corrosion.
3. No interstage leakage.
4. Wide range exact pressure governing.
5. Loss of suction reduces speed without tripping; automatic speed recovery with suction restoration.
6. High efficiency pump plus high speed two-bucket row turbine result in minimum steam consumption.
7. Matched Pump, Turbine and Governors under one responsibility.
8. Exact hydraulic and mechanical balance—light weight rotor—large bearings; result: bearing troubles practically unknown.
9. Pump Gland Leakoff provides adequate recirculation; suction pressure only on packing.
10. Rigid one-piece steel casing plus heavy shaft plus ample clearances result in no damage from dry operation.
11. All parts made to gage and replaceable without fitting; all parts in stock at factory with wearing parts available from agencies' stocks.
12. Proved for performance over a period of more than twenty years in service.
13. Compact, light in weight, quiet and low in maintenance.

Literature sent on request; specific proposals on receipt of operating date.

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The Most Complete Line of Products in the Industry

Whatever the problem—whether heating an apartment—dehumidifying the air in a blast furnace—attracting mid-summer business to a restaurant—preventing ether explosions in a hospital operating room—Trane Heating and Air Conditioning Systems offer the correct solution. To make this versatility in heating and air conditioning possible, Trane furnishes the most complete line of products in the industry.

Trane products are developed, tested, and built to the highest engineering standards ... with the added advantage that every Trane product is designed to match every other Trane unit. Thus Trane systems give the performance that is only possible when every component is operating in complete harmony with every other.

The completeness of the Trane line makes it possible for the architect, engineer, and contractor to specify from *one source* in planning Trane Heating and Air Conditioning Systems. Trane field offices in 85 principal cities co-operate with them.

* * *

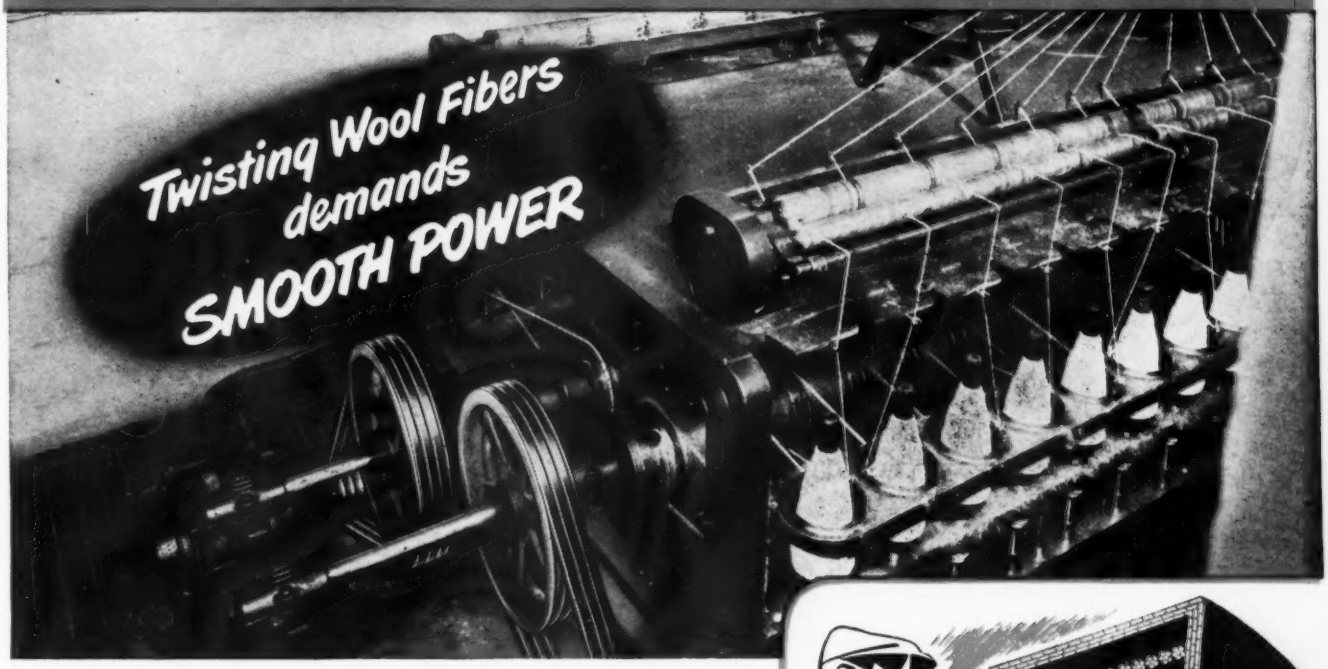
The Convector-radiator—modern successor to the old-fashioned cast iron radiator—has been engineered by Trane for universal application to steam and hot water heating systems, and is being produced in quantity so you can soon secure it from local distributors' stocks.

TRANE

Manufacturing Engineers of Equipment for
HEATING AND AIR CONDITIONING

THE TRANE COMPANY, LA CROSSE, WISCONSIN • *Also* TRANE COMPANY OF CANADA, LTD., TORONTO, ONTARIO

WHY DAYTON V-BELTS *Start and Run Smoothly*



Machines that twist wool fibers and run the yarn onto spools are delicate. Power drives must start and run smoothly or machines quickly get out of order. In the plant of a manufacturer of papermakers' felts, rough starting and stopping, plus the slipping of the original power drive on a twister machine, caused it to be out of operation frequently for hours at a time. Loss of production was serious. Then, five years ago, a Dayton V-Belt Drive was installed. Since then the twister has not been out of service once due to power drive failures.

Dayton V-Belts start, run and stop smoothly because they wedge themselves in the pulley groove, thereby absorbing the shocks of suddenly applied power when motors are started or when peak loads suddenly come on. Smooth starting is one of many reasons why Dayton V-Belts can help you solve your power transmission drive problems efficiently and economically. Your Dayton Distributor will gladly help you. Call him today.

DAYTON RUBBER • DAYTON, OHIO

Branch Offices: Atlanta • Boston • Chicago • Cleveland • Dallas
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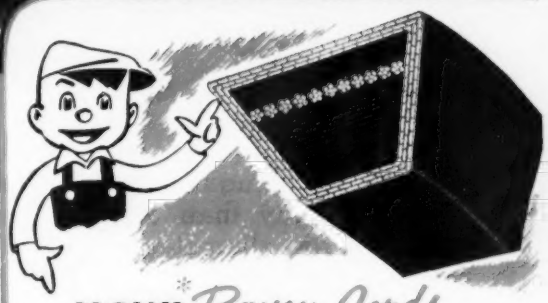

NOW! *Rayon Cords

PROVIDE DAYTON V-BELTS WITH

1. **MINIMUM STRETCH**
2. **GREATER FLEX STRENGTH**
3. **LONGER V-BELT LIFE**

*Rayon cords are specially processed by Dayton for use in V-Belts to provide the most efficient and economical power transmission service for your needs. For the complete story, write for booklet A-469.

V-BELT BUYERS! A leading mill supply house near you stocks Dayton V-Belts.. Look for the name in the yellow pages of your telephone directory

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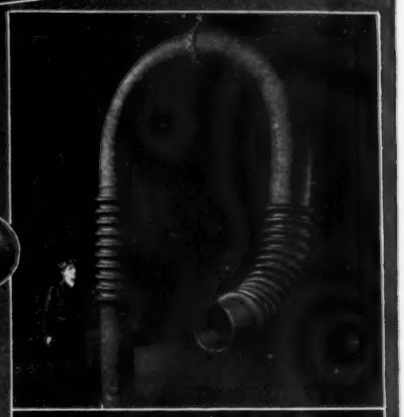
THE MARK OF TECHNICAL EXCELLENCE IN NATURAL AND SYNTHETIC RUBBER

THE WORLD'S LARGEST MANUFACTURER OF V-BELTS

P.P.&E. CREASED BENDS *and* Corrugated Tangents

SAVE SPACE



REDUCE STRESS

IMPROVE OPERATION

A P. P. & E. Corrugated Tangent has much more flexibility than a straight pipe of equal length, diameter, and wall thickness. A creased bend maintains full wall thickness on the outside of the bend.

This inherent flexibility minimizes movement caused by thermal expansion. It makes practicable the use of shorter radius bends, with full wall thickness, without causing excessive end reaction against equipment. It also makes possible higher head clearances, more easily accessible valves, and more convenient location of auxiliary equipment.

Creased Bends and Corrugated Tangents can be prefabricated by us in any practical design. This is an important feature, since the characteristics of this type of piping often permit installation of a more complex system in an existing structure, thus avoiding need for constructing or enlarging a building. Consult our nearest representative.

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AND EQUIPMENT COMPANY
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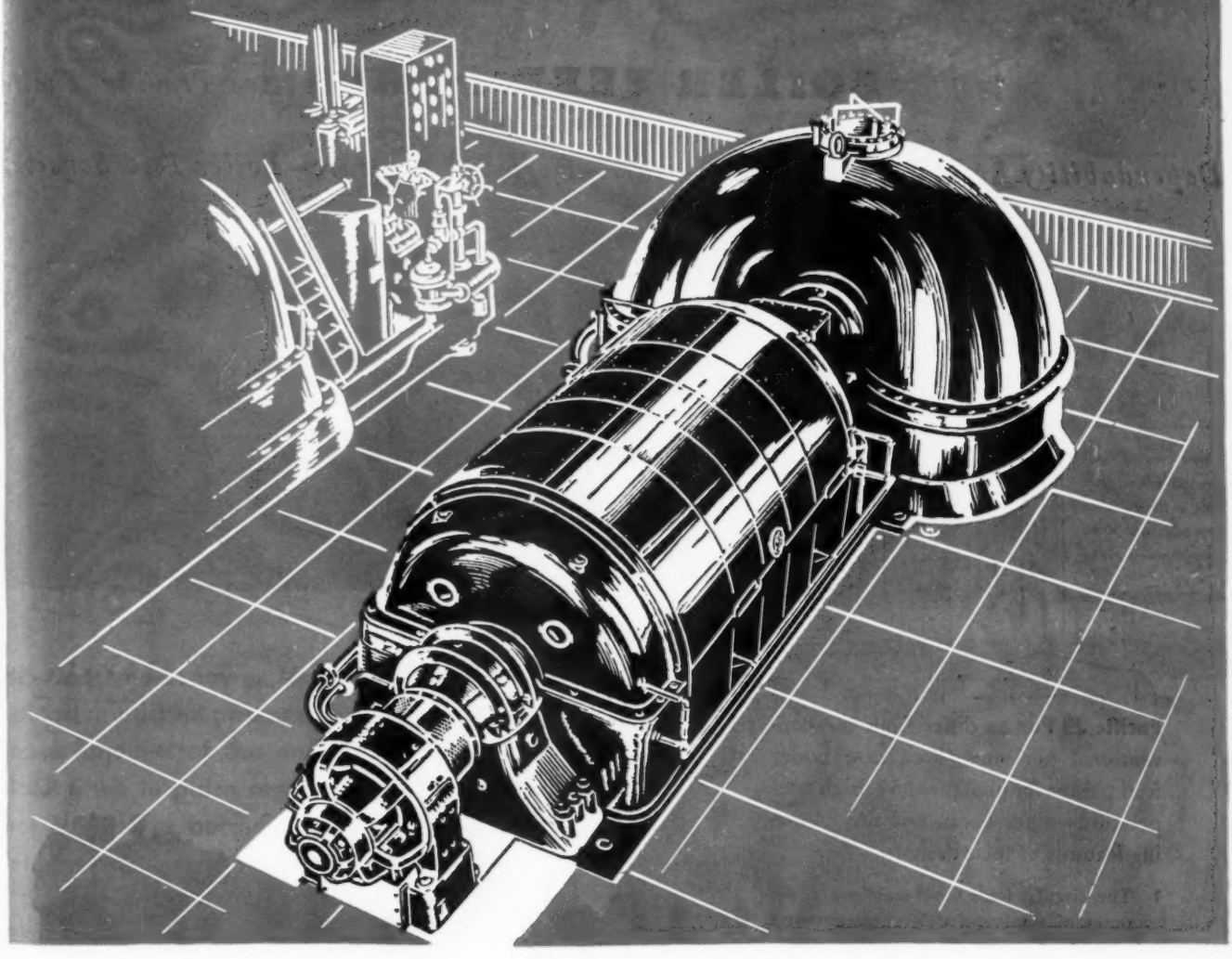
Whitehead Building, Atlanta

"ABSOLUTE ABSENCE OF SLUDGE



...since using Tycol turbine oils"

TYCOL
INDUSTRIAL LUBRICANTS

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TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE • NEW YORK 4, N. Y.

"Ten years without an oil change... Bearings show no sign of wear..."

These results are typical of the unusual performance achieved with Tycol Turbine Oils. Refined by a special process, these modern lubricants stand up under the toughest service conditions . . . retain their original characteristics.

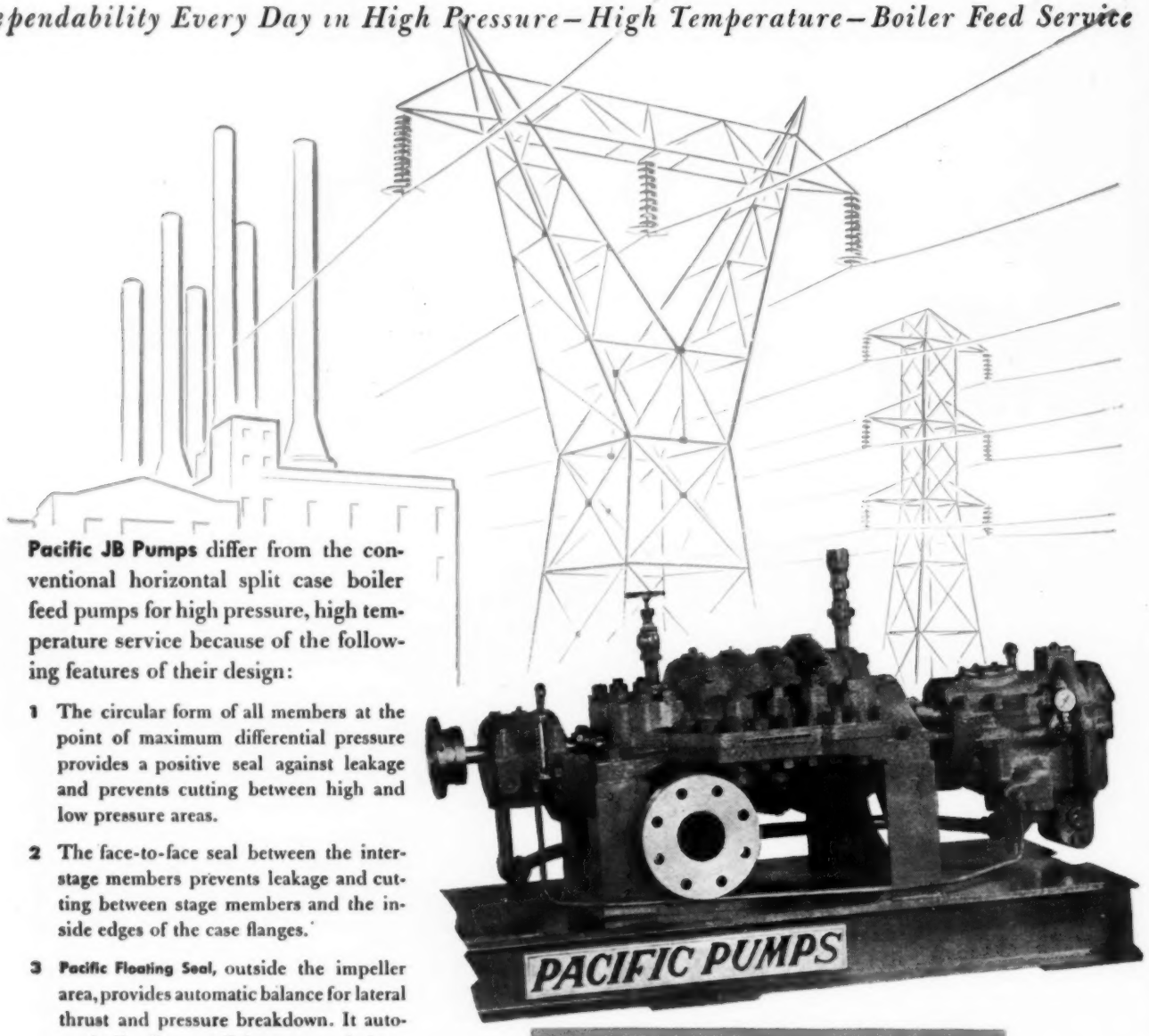
Call your nearest Tide Water Associated Office today for full information about the time- and money-saving advantages of Tycol Turbine Oils. Rust inhibited *Tycol RIO Turbine Oils* are also available for operations where corrosion is a factor.

LUBRICATION—"ENGINEERED TO FIT THE JOB"

More than 200

PACIFIC JB BOILER FEED PUMPS *Are Proving Their*

Dependability Every Day in High Pressure–High Temperature–Boiler Feed Service



Pacific JB Pumps differ from the conventional horizontal split case boiler feed pumps for high pressure, high temperature service because of the following features of their design:

1. The circular form of all members at the point of maximum differential pressure provides a positive seal against leakage and prevents cutting between high and low pressure areas.
2. The face-to-face seal between the interstage members prevents leakage and cutting between stage members and the inside edges of the case flanges.
3. **Pacific Floating Seal,** outside the impeller area, provides automatic balance for lateral thrust and pressure breakdown. It automatically allows sufficient external circulation to prevent "flashing" and "vapor binding" at reduced capacities and "shutoff."

Write for Bulletin 82 for complete information on
TYPE JB BOILER FEED PUMPS

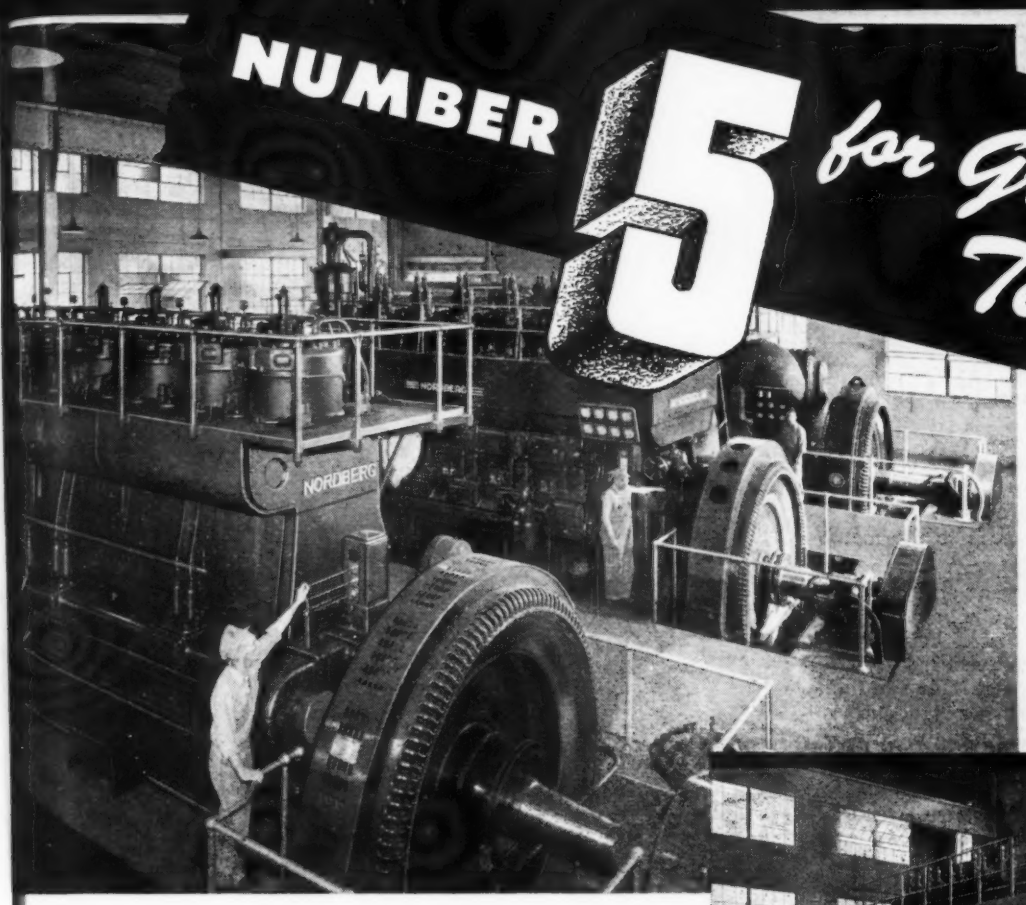
PACIFIC PUMPS, INC.
HUNTINGTON PARK, CALIFORNIA

PACIFIC
Precision Built
PUMPS

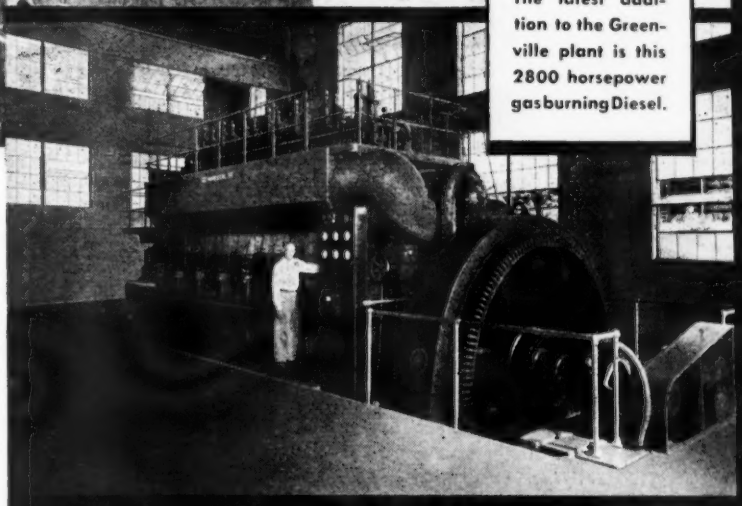
One of the Dresser Industries

OFFICES IN ALL PRINCIPAL CITIES—EXPORT OFFICE: 122 E. 42ND STREET, NEW YORK CITY

NUMBER 5 for Greenville, Texas



The latest addition to the Greenville plant is this 2800 horsepower gas burning Diesel.



THIS 9650 horsepower Nordberg Diesel engined municipal power plant at Greenville, Texas is another of the many satisfied users that continue to place repeat orders for additional Nordbergs because of the years of excellent performance of their engines. Following the initial installation of two engines in 1933, units were added in 1938, 1942 and 1946, the last two installed using natural gas for fuel.

The performance of Nordberg Diesels at Greenville has been noteworthy. In addition to being dependable, they have been economical, the latter being shown by the fact that Greenville has a lower rate than any city of comparable size in Texas. If you are considering power units, investigate the merits of Nordberg Diesel Power.

NORDBERG MFG. CO.
MILWAUKEE 7, WISCONSIN

These 1000 and 1450 horsepower Nordberg units comprised the initial installation at Greenville.

NORDBERG
DIESEL ENGINES

Why go to all the trouble?

Sand-packing prevents flattening of the walls when piping is bent—and the results are easy to see.

But *you* can't see what happens to the metal in the bending process.

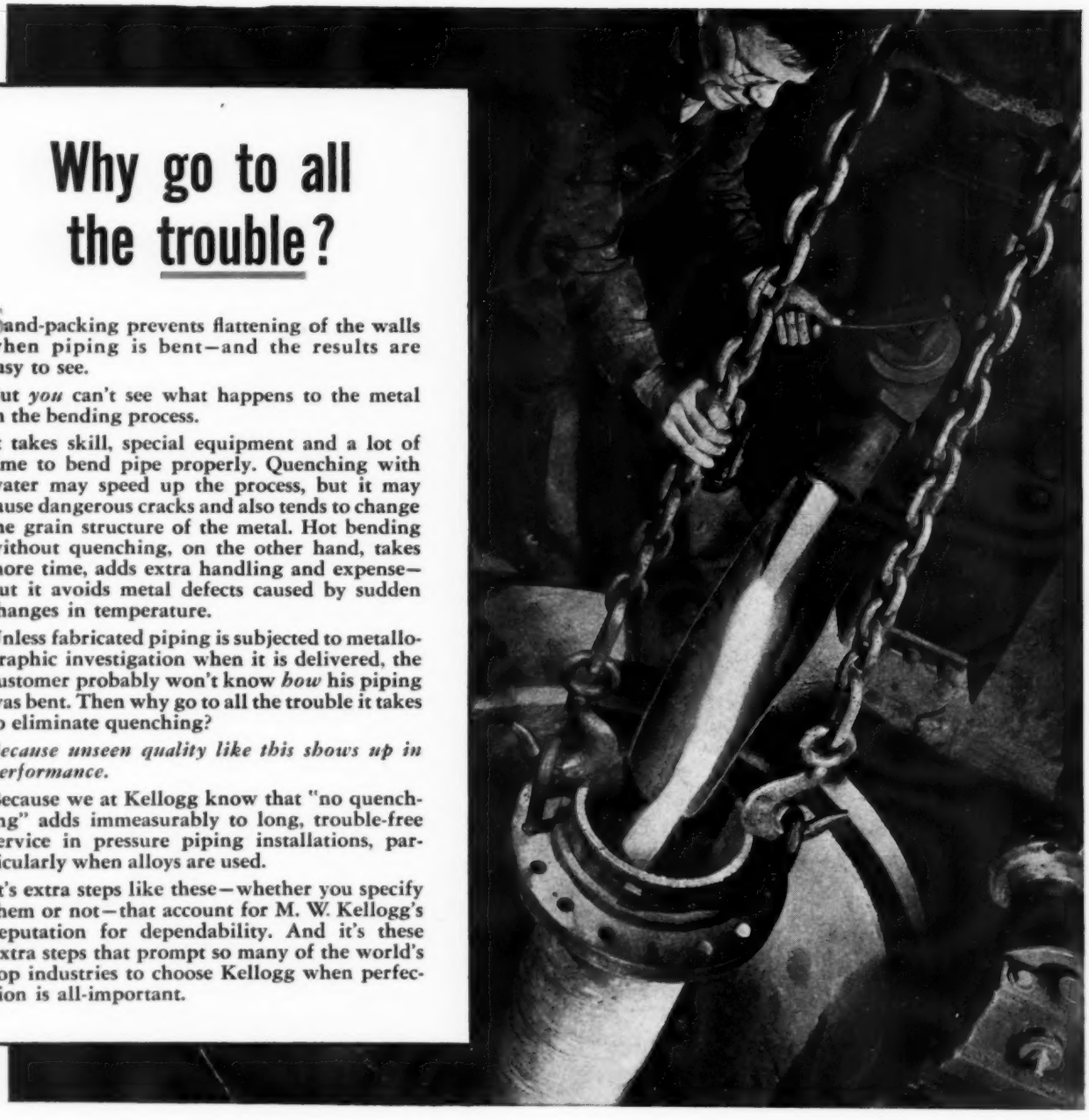
It takes skill, special equipment and a lot of time to bend pipe properly. Quenching with water may speed up the process, but it may cause dangerous cracks and also tends to change the grain structure of the metal. Hot bending without quenching, on the other hand, takes more time, adds extra handling and expense—but it avoids metal defects caused by sudden changes in temperature.

Unless fabricated piping is subjected to metallographic investigation when it is delivered, the customer probably won't know *how* his piping was bent. Then why go to all the trouble it takes to eliminate quenching?

Because unseen quality like this shows up in performance.

Because we at Kellogg know that "no quenching" adds immeasurably to long, trouble-free service in pressure piping installations, particularly when alloys are used.

It's extra steps like these—whether you specify them or not—that account for M. W. Kellogg's reputation for dependability. And it's these extra steps that prompt so many of the world's top industries to choose Kellogg when perfection is all-important.



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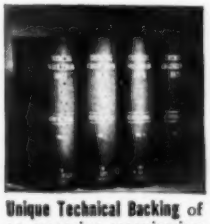
PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.



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Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

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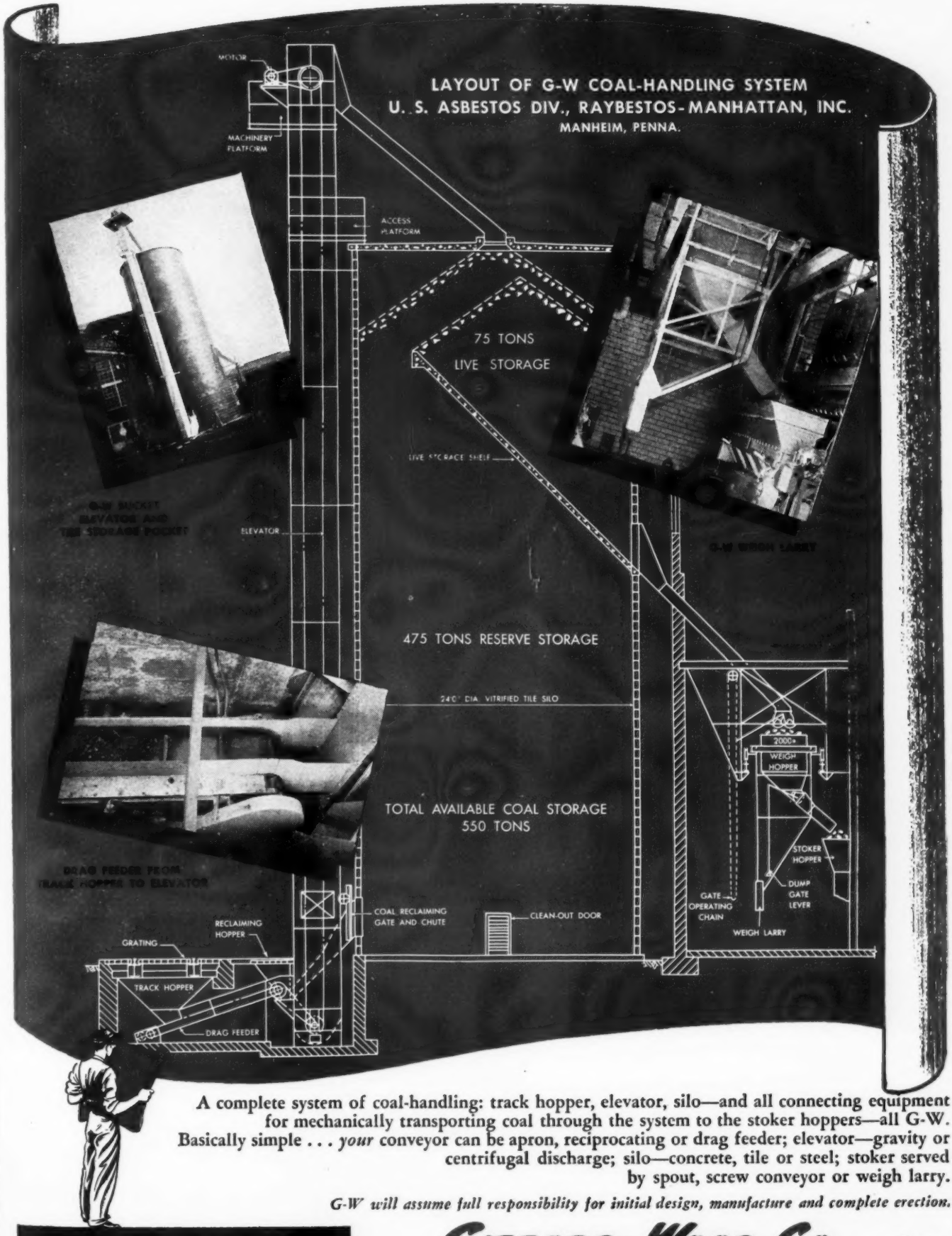

A complete system of coal-handling: track hopper, elevator, silo—and all connecting equipment for mechanically transporting coal through the system to the stoker hoppers—all G-W. Basically simple . . . *your* conveyor can be apron, reciprocating or drag feeder; elevator—gravity or centrifugal discharge; silo—concrete, tile or steel; stoker served by spout, screw conveyor or weigh larry.

G-W will assume full responsibility for initial design, manufacture and complete erection.

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K & M "Century" ASBESTOS CORRUGATED

What will determine the choice of building materials for your new plant, or remodeling job?

Will it be—

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Construction economy?
Speed of application?
Resistance to fire, weather, rust, other conditions?
Strength, durability?
Freedom from painting and other upkeep?

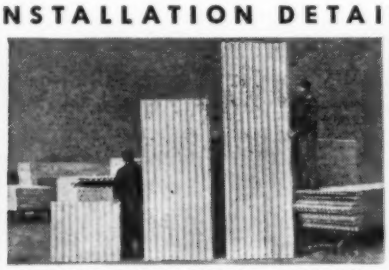
Regardless of which of those qualities you seek, K&M "Century" Asbestos Corrugated is an ideal choice, for it incorporates *all* of them in every rugged sheet. Being made of indestructible asbestos and Portland cement, it can't burn, can't rot, can't rust. Considering these many advantages, its cost is moderate, and it will pay for itself many times over in long maintenance-free life.

"Century" Asbestos Corrugated is easy to cut with portable electric or band saw, and easy to drill for drive screws or bolts. Cutting and fitting time is held to minimum because of 19 available sheet lengths. Salvage value is practically 100%.

If you'd like further information about "Century" Corrugated, write us, we'll be glad to help you.

INSTALLATION DETAIL

RIDGE ROLL



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CORNER ROLL

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Reg. U. S. Pat. Off.

Take a *good* look at a *Liability*

Any boiler plant becomes a liability when improper water conditioning eats up profits by causing excessive blowdown, carryover . . . scale.

But this liability can be turned into an asset with *correct* water conditioning . . . a matter of careful and scientific control.

W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical. Our staff of engineers will welcome the opportunity of discussing your boiler water problems . . .
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COST CUTTERS

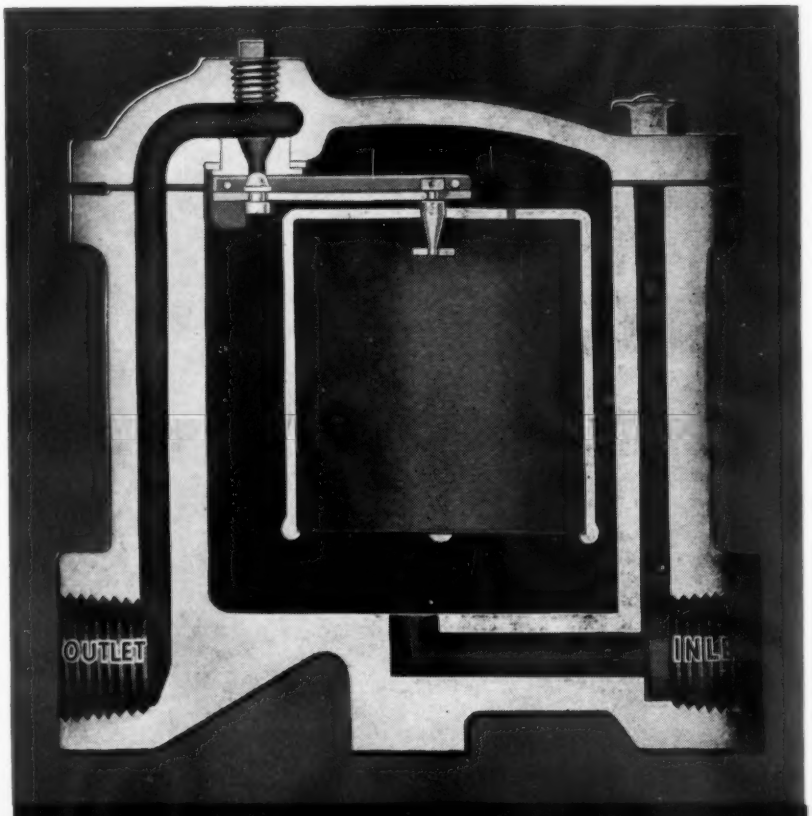
POWER PLANTS . . . cut costs with CLARK STEAM TRAPS. Large volume air removal gives quicker heating up action—saves fuel. Elimination of condensate permits rapid, full flow of new dry, live steam—extends life of equipment.

For 38 YEARS...

fluid controls made by Clark have been saving fuel and increasing equipment efficiency wherever steam, air or gas are used.

Cost Cutters in...

- **Laundry and Dry Cleaning Establishments**
- **Petroleum Refineries**
- **Food Processing and Canning Plants**
- **Meat Packing Plants**
- **Steel Plants**
- **Breweries**
- **Chemical Plants**
- **General Industry**



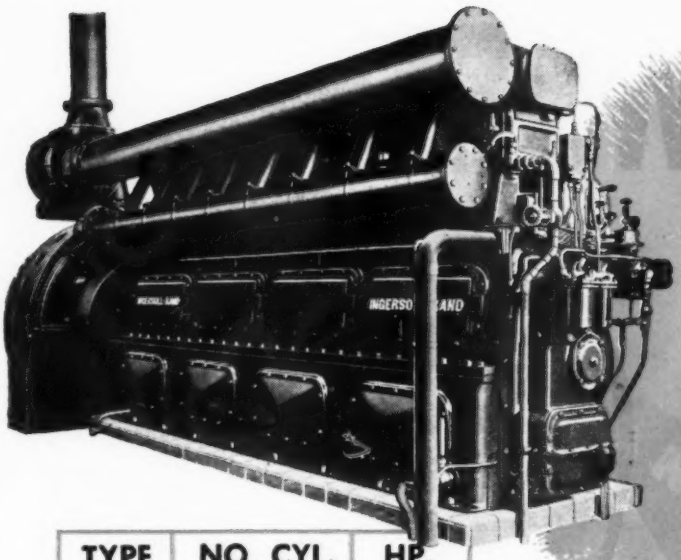
The popular **CLARK SERIES 70** Inverted Bucket Type Steam Trap with Clark patented Bucket Venting Device and other exclusive Clark features. For general drainage service. Available in 3 sizes: ½", ¾" and 1". For pressures up to 200 P. S. I. and temperatures up to 400° F. Write for free catalog for complete specifications and applications of the wide line of Clark Fluid Controls.

Clark
FLUID CONTROLS

THE CLARK MANUFACTURING COMPANY • DEPT.A • CLEVELAND 14, OHIO

Makers of a wide line of fluid controls including

STEAM AND FLUID TRAPS	STRAINERS	PRESSURE REGULATORS
VACUUM AND LIFTING TRAPS	VALVES	REDUCING VALVES



TYPE	NO. CYL.	HP.
SS	6	675
SS	7	785
SS	8	900

THERE'S POWER *Plus* IN I-R "SUPER S" DIESELS

● You'll get extra power from turbocharged Ingersoll-Rand Type "SS" Diesels . . . 50% more power than from an unsupercharged engine of equal displacement.

Besides this, you'll get . . .

POWER you can rely on—
PLUS low fuel consumption (.38 lb. per bhp-hour at full and ¾ load, .40 lb. at ½ load).

POWER for driving generators, blowers, pumps—
PLUS better generator efficiencies and more conservative gear ratios for blower and pump drive.

POWER for mines, factories, ships, refineries, pipelines
PLUS low maintenance costs.
Conservatively loaded bearings, controlled cooling and small easily replaceable parts result in low maintenance.

POWER wherever you need it—
PLUS small foundation and low headroom requirements.

If you're thinking of a Diesel installation, look to the POWER PLUS of I-R Diesels. They are built in 3, 4, 5, 6, 7 and 8 cylinder sizes ranging from 225 to 900 hp. An engineer from any of our branch offices will be glad to give you full details.

11-7

COMPRESSORS • AIR TOOLS
ROCK DRILLS • TURBO BLOWERS
CENTRIFUGAL PUMPS • CONDENSERS
OIL & GAS ENGINES

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y.

NO GUESSWORK

WITH THIS EXPANSION JOINT

E. B. Badger & Sons Company is the original and sole manufacturer of* BADGER *Expansion Joints

BADGER Packless DIRECTED FLEXING Corrugated Expansion Joints are built with *known factors* that leave nothing to guesswork. You can readily determine the number of corrugations needed, since the maximum traverse per corrugation is consistent for each size. No needless, costly over-traverse; no inadequate, dangerous under-traverse. For example:

Diameter	*Depth of Corrugation*	*Traverse per Corrugation*
4" and 5"	1⅛"	5/16"
6"	1¾"	½"
8" and 10"	2¼"	5/8"
12" and larger	2¾"	¾"

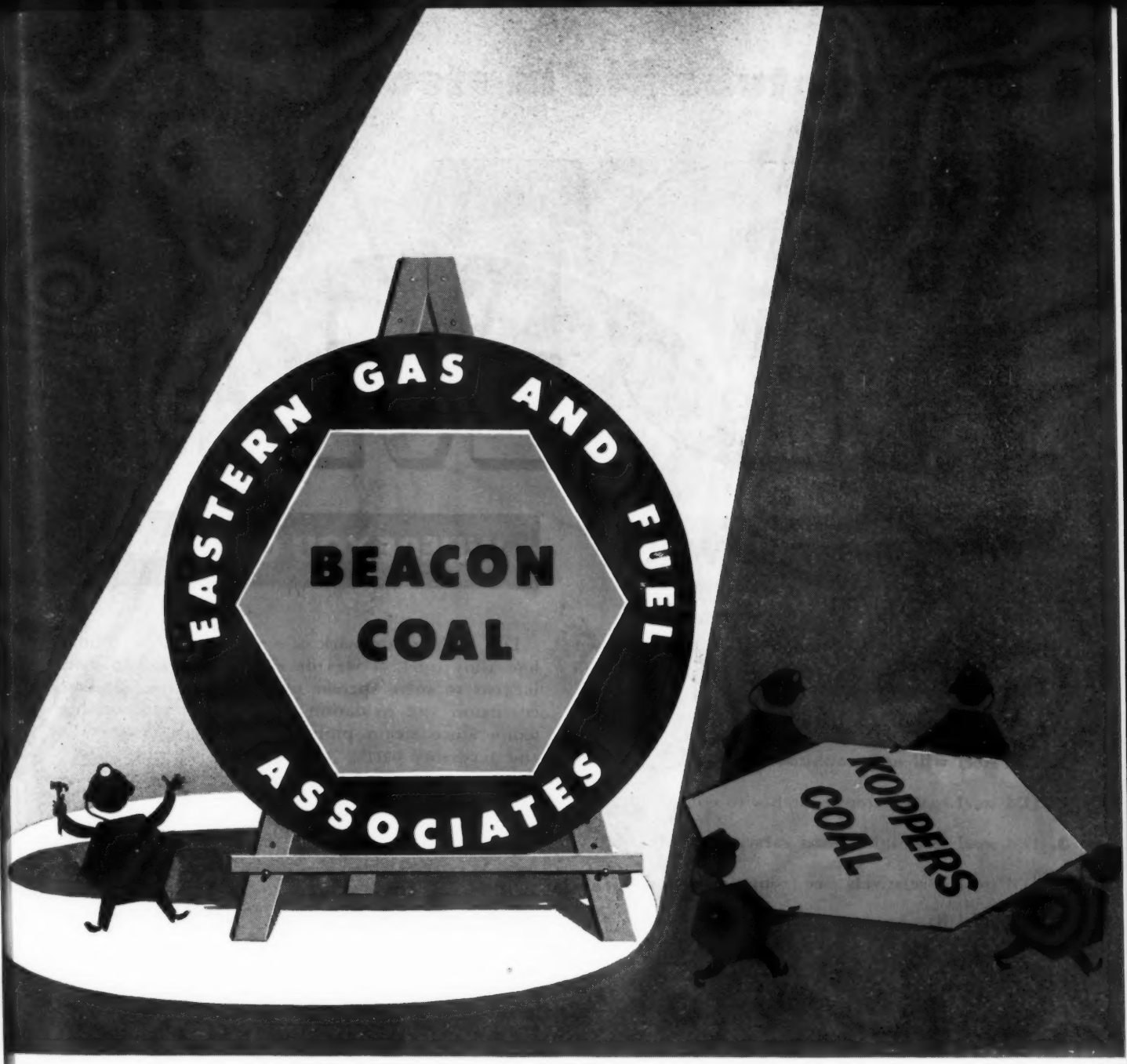
Then its flexing is *directed* and held to the predetermined range by Badger DIRECTED FLEXING equalizing rings (patented). The *ALL-CURVE* engaging surface of the rings conforms to the *ALL-CURVE* contour of the corrugation. This combination means even distribution of stresses — not only throughout each corrugation, but also among all corrugations. There are no angular junctions in which stresses can localize.

MADE IN COPPER, STAINLESS STEEL AND OTHER ALLOYS — Copper for normal pressures and temperatures; Stainless Steel and other alloys for higher requirements—and where corrosion is a problem. Single or multiple corrugations—for traverses from a fraction of an inch upward. Also made in Non-equalizing type (without rings) for uses that do not require added protection. SEND FOR BULLETIN No. 100 (*Self-equalizing*) or No. 200 (*Non-equalizing*).

Badger

E. B. BADGER & SONS CO., Cambridge Division, 260 Bent St., Cambridge 41, Mass.
AGENTS IN PRINCIPAL CITIES

PACKLESS CORRUGATED EXPANSION JOINTS



We announce the trade name BEACON COAL for the famous line of quality coals which has for many years been marketed under the KOPPERS name.

EASTERN GAS AND FUEL ASSOCIATES, COAL DIVISION

PITTSBURGH • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • NORFOLK • PHILADELPHIA • SYRACUSE

For longer tube life in steam service . . .

"DM"

WHAT IT OFFERS YOU:

Because of the 6 important characteristics shown below, Timken DM tubes offer long, economical life and dependable service to steam power plant operators. Here's how it compares to ordinary 0.50 Mo steel:

1. DM steel will not graphitize
2. DM steel has greater resistance to corrosion
3. DM steel has higher load carrying ability
4. DM steel is relatively free from air hardening
5. DM steel has greater resistance to oxidation
6. DM steel has good structural and physical stability for service up to 1150°F.

WHERE YOU CAN GET IT:

DM is the trade-mark of a special analysis Timken fine alloy steel. It was developed by Timken metallurgists to solve specific problems of heat, pressure, corrosion and oxidation in superheater tubes, high temperature steam piping, and forgings for valves and accessory parts.

Like all Timken high temperature steels, DM is the product of years of experience and research which have made The Timken Roller Bearing Company's Technical Staff the recognized authority on high temperature applications. And uniform quality of every DM tube is assured by the Timken Company's complete control of its manufacture, from melt shop through final tube inspection.

For full information on how DM can solve *your* tube problems and give you maximum tube life per dollar invested, consult our Technical Staff. Also write for "Digest Supplement No. 2 on Timken DM and DM-2 Steels". Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

Fine Alloy

STEEL

and Seamless Tubes

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.

Look at the record for proof of

FAIRBANKS-MORSE DIESEL SUPERIORITY

Yes, you'll be convinced that Fairbanks-Morse Diesels are dependable, efficient, economical—performance records in every field of industry prove it.

In plain, factual terms, these records say Fairbanks-Morse Diesels minimize fuel costs . . . keep maintenance costs down . . . have maximum reserve power . . . give sustained heavy-duty service even under extreme conditions.

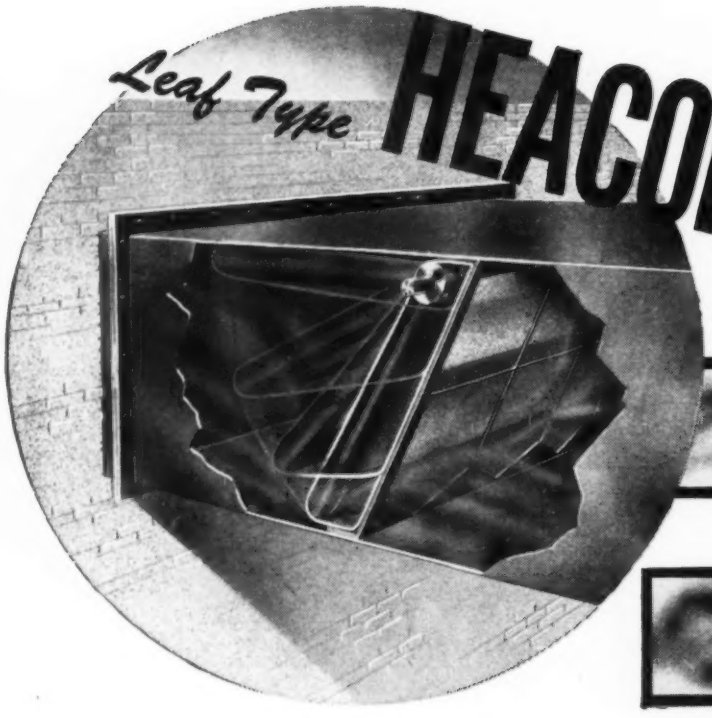
Will they do the same for you? There is every reason they will—no matter what your power requirements are. Remember—diesels save fuel because they generate more power per gallon than any other power producer that uses oil. A Fairbanks-Morse engineer will be glad to talk over your problems with you. Write today for full particulars. Fairbanks, Morse & Co., Chicago 5, Illinois.

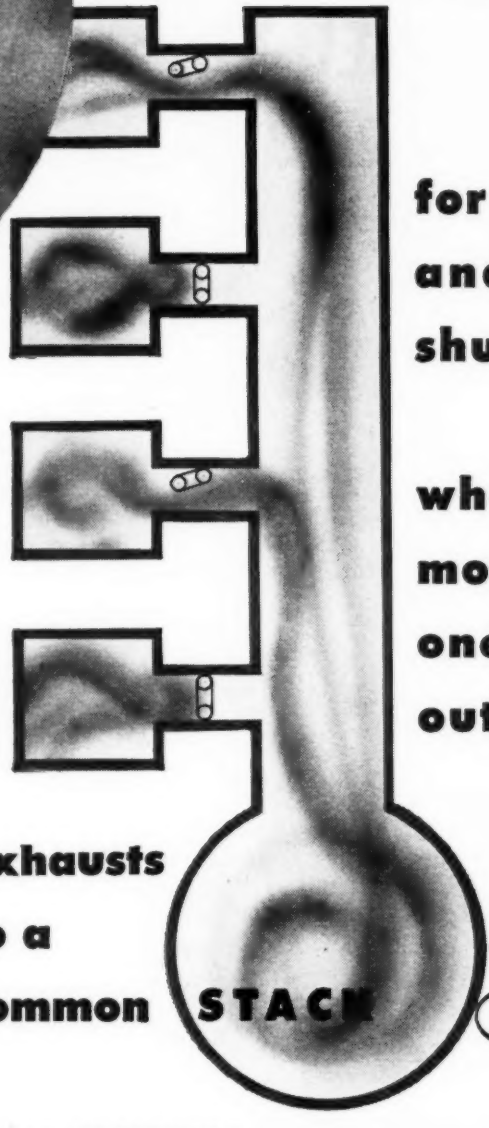
Diesel Locomotives
Diesel Engines
Generators • Motors
Pumps • Scales
Magnetos • Stokers
Railroad Motor Cars
and Standpipes
Farm Equipment

Fairbanks-Morse

A name worth remembering

Leaf Type HEACON DAMPERS





for control and tight shut off...

where more than one boiler outlet

exhausts to a common STACK

HEACON

The Heacon Damper is fundamentally a tight sealing damper, designed to hold heat in the boiler when closed and to permit accurate control of the smaller increments by means of V-porting as it opens.

The "LH" or Leaf Type Heacon provides, at a lower cost, the advantages of tightness and control found in the SVH type Heacon Dampers and is particularly adaptable to smaller ducts.

The curtain in the LH type, as in the SVH, is of asbestos, held on the damper seals by the draft when closed and peels off (illustrated in inset) as it opens.

The basic difference in design between the LH and SVH Heacon Dampers is in the method of opening the damper. In the LH, the frame peels the curtain from the seals as it rotates away from the damper frame; while in the SVH Heacon type, the curtain is peeled from the seals as it is rolled upward. Obviously, the SVH type transmits no static torque to the operating spindle whereas there is a static torque in the LH operation.

Advantages of Heacon Dampers include: elimination of excessive leakage during shut down or banking periods . . . more accurate control with a consequent increase of range and output.

Our field engineers will be glad to show you the advantages of a Heacon Damper. Call or write the office nearest you.

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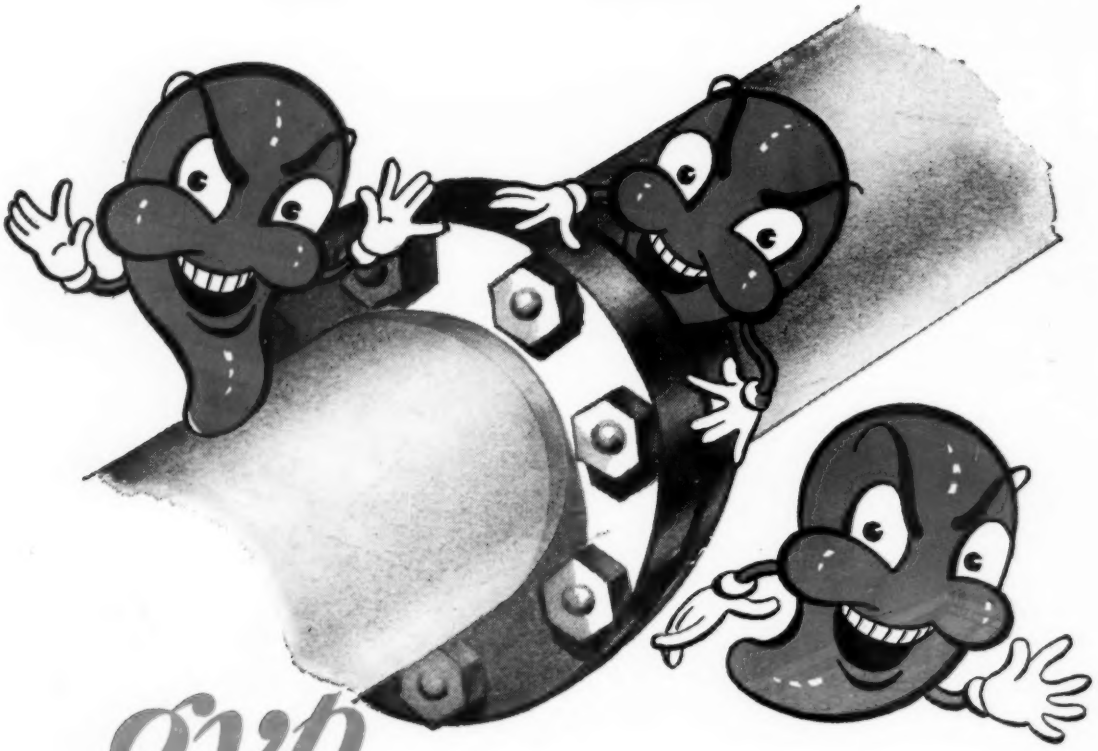
HONEYWELL *Controls* FOR EVERY INDUSTRIAL NEED!

PICK your spots. At any point on the plan there are Honeywell controls for heating, ventilating and air conditioning to meet the individual problem presented. And for control of process operations that involve temperature, humidity, pressure or flow, Honeywell's Brown instruments are used to maintain *automatically* the exact conditions required.

Wherever Honeywell controls are used, it's assurance of plant heating, ventilating and air conditioning equipment operating according to design—at its best. In a wide variety of industries the uncanny sensitivity and accuracy of Brown instruments for recording, controlling or indicating are daily playing a vital part in maintaining product uniformity, speeding output and lowering costs.

Call on Honeywell for consultation about every kind of automatic control question. Honeywell's 60-year background of engineering knowledge and experience represents the ability to recognize the problem, the requirements and the solution. Simply phone or write the Honeywell branch in or near your city. Minneapolis-Honeywell, Minneapolis 8, Minnesota. In Canada: Toronto 12, Ontario.

MINNEAPOLIS
Honeywell
AUTOMATIC CONTROLS AND
BROWN INDUSTRIAL INSTRUMENTS



gyp joint

BTU's escaping from one pair of bare, 10-inch flanges at 350° F. can waste a ton of coal a year. If that isn't a "gyp joint," you name it!

But whatever you call it, it looks just as sour on a cost sheet. Day after day, year after year, inefficient insulation (or *no* insulation) costs industry countless BTU's . . . countless dollars.

YOU CAN CHECK THOSE LOSSES—CUT COSTS . . . by making sure that plant insulation is as efficient as production factors *must* be today. The quick, easy way to do that is to make full use of . . .

CAREY'S COMPLETE INSULATION SERVICE. That includes well 'rounded insulation engineering facilities . . . the know-how for any size job . . . a complete line of insulations for industrial needs, developed by 74 years of experience in serving industry . . . warehouse stocks from coast to coast, to provide prompt, thorough service.

Call **CAREY** for *any* insulation requirement . . . from a survey to a complete installation. You'll get quick action on any request, whether you need help to solve an immediate insulation problem or whether you simply . . .

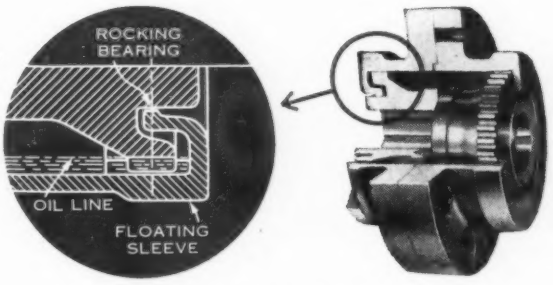
WRITE FOR YOUR FREE COPY . . . of this helpful booklet. It's an excellent guide to selection of proper insulation, contains specifications and tables you want handy for ready reference. Gives a complete picture of the **CAREY** Heat Insulation line, too. A *free* copy of "Heat Insulation For Industry" is yours for the asking. Address your request to Dept. P-11.

Carey

Industrial Insulation • Rock Wool Insulation
Careyduct • Asbestos Wallboard & Sheathing
Asphalt Shingles & Roofings • Built-up Roofing
Roof Coatings & Cements • Pipeline Felt
Asphalt Tile Flooring • Waterproofing Materials
Expansion Joint • Asbestos Shingles & Siding
Corrugated Asbestos Roofing and Siding
Miami-Carey Bathroom Cabinets & Accessories

THE PHILIP CAREY MANUFACTURING CO., CINCINNATI 15, OHIO

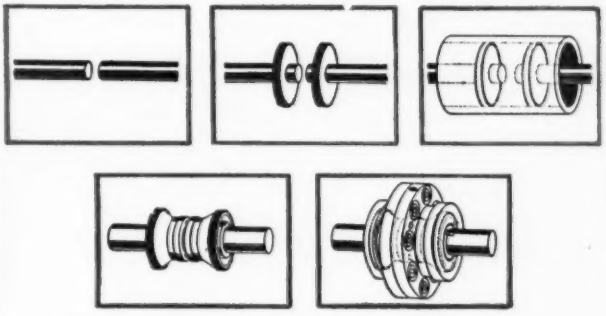
In Canada: The Philip Carey Co., Ltd.
1557 MacKay Street, Montreal 1, P. Q



HERE'S HOW FAST'S Eliminates Perishable Parts!

No matter which type of Fast's Coupling you use, you can be sure of this . . . it will be all-steel throughout . . . without a single perishable part! As an example, the exclusive "rocking bearing," shown above, provides a positive metal-to-metal seal to protect the load-carrying oil against moisture, dust and grit. No perishable packing rings are used. There's nothing to wear, nothing to fail.

1

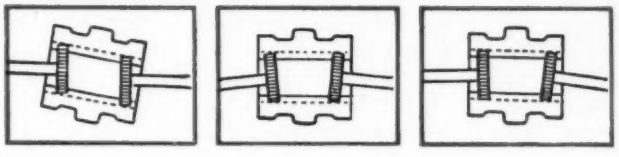


HERE'S HOW FAST'S Are Constructed— Simple as A-B-C!

See the simple development of Fast's self-aligning Couplings. A splined hub on each shaft end. A sleeve with internal splines to mesh. Oil in the sleeve, kept between the splines by centrifugal force, carries the load between the splines.

2

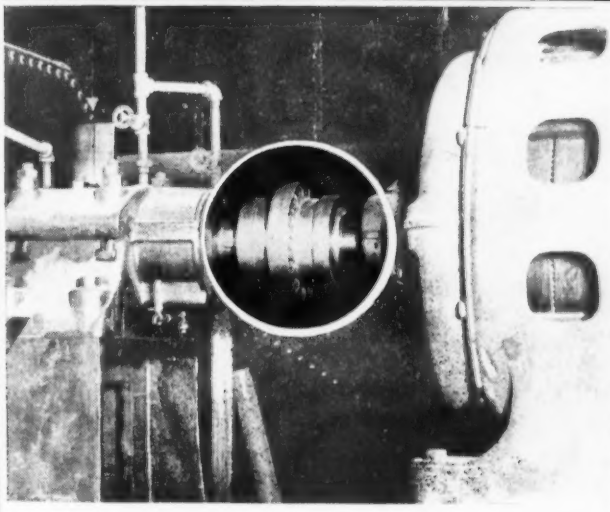
These Facts About the ORIGINAL Gear-Type Coupling *Can Save You Costly Coupling Shutdowns*



HERE'S HOW FAST'S COUPLINGS Compensate for Misalignment!

The floating sleeve takes a neutral position. All forms of misalignment are compensated for between the lubricated faces of the splines, equally divided between the driving and driven members. The entire assembly revolves as one unit.

3



HERE'S HOW FAST'S COUPLINGS ARE USED

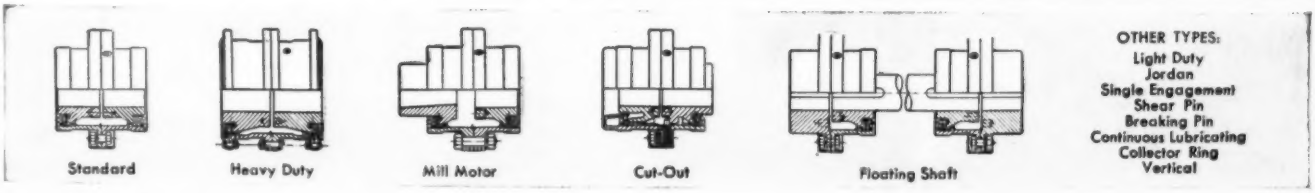
This No. 4 Fast's Coupling, connecting a motor and induced draft fan at the West Penn Power Company's Beach Bottom, W. Va., plant, is a good example of the way industry uses Fast's Couplings for uninterrupted power transmission. When you buy Fast's Couplings, you buy years of top engineering experience, Koppers' high standard of workmanship and unexcelled coupling service. Result: longer machine life, lower upkeep costs, minimum shutdown losses.

4

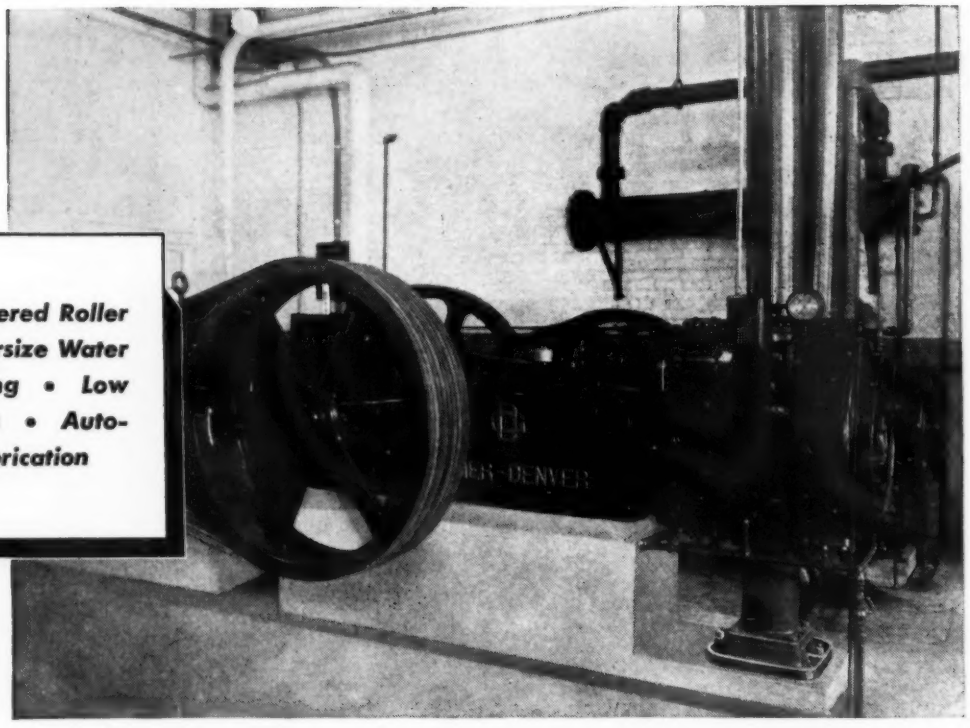
***WE HAVE** a complete line of couplings for immediate delivery. Get full details on Fast's Couplings now by writing for our complete catalog. Just drop a line to:* Koppers Co., Inc., Fast's Coupling Dept., 341 Scott St., Baltimore 3, Md.

K KOPPERS

FAST'S *self-aligning* COUPLINGS



Double Row Timken Tapered Roller Main Bearings • Oversize Water Jackets for Efficient Cooling • Low Lift, Air Cushioned Valves • Automatic and Reliable Lubrication



Gardner-Denver RX, single-cylinder horizontal, double-acting, single-stage compressor—available in capacities from 89 to 1292 cubic feet displacement per minute.

No wonder it will run Continuously

Every part of a Gardner-Denver "RX" Air Compressor is built for heavy-duty, full-load, continuous service. And with such service goes high volumetric and mechanical efficiency—unusually low power costs! Here are additional features which make the RX a favorite in so many industries:

★ *Duo-plate cushioned valves—simple, durable, unusually quiet.*

★ *Large and unrestricted port areas help reduce heat of compression; insure effective lubrication with minimum oil consumption.*

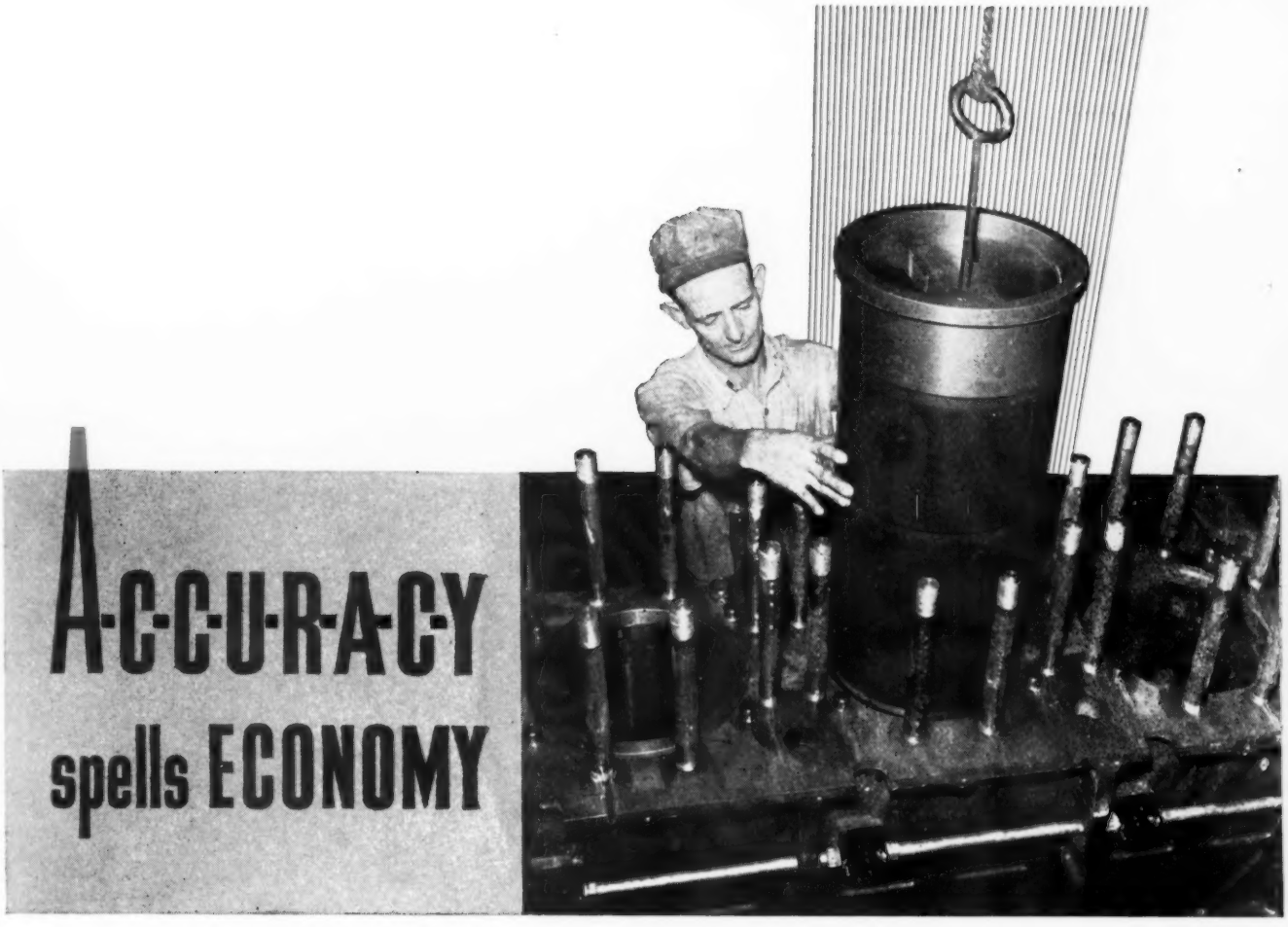
★ *Suction valve unloaders on all inlet valves result in lowest power consumption during unloaded period.*

★ *Oil-tight, dust-tight construction.*

For complete information about Gardner-Denver RX Compressors, write Gardner-Denver Company, Quincy, Illinois

USE COMPRESSED AIR FOR SAFETY CONVENIENCE FLEXIBILITY

GARDNER-DENVER
SINCE 1859



A-C-C-U-R-A-C-Y spells ECONOMY

. . for Superior Diesel Engine Buyers

● Behind the alert, surging power of Superior Diesel Engines is a long standing reputation for economy. To earn that recognition . . . to build it . . . to hold it . . . has demanded parts of the finest material, built to extreme accuracy.

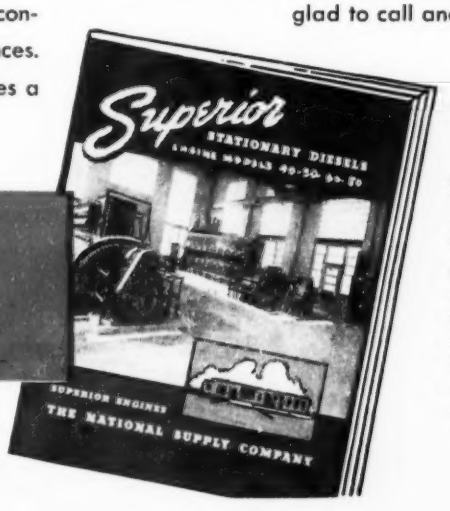
Replaceable cylinder liners offer factual evidence of the careful manufacturing practices that mark every Superior Diesel Engine. This vital part is made in Superior's own foundry of a special, close grained semi-steel analysis. They are machined all over to insure uniform expansion and contraction. Every cylinder is bored to the same close tolerances. The results are a uniform accurate piston fit which assures a quiet running engine and long piston and liner life.

Because all cylinder liners are interchangeable and simple to remove they can be replaced with ease. Consequently, if only one cylinder needs repair, the entire block does not have to be replaced. This provides substantial operating and maintenance economies.

Cylinder liners are just one of the features that have helped to build Superior's reputation for quality and economy. There are many others. One of our representatives will be glad to call and describe them in detail.

Superior DIESEL

SUPERIOR ENGINE DIVISION OF
THE NATIONAL SUPPLY COMPANY
Plant and General Sales Office: Springfield, Ohio



Send for this Booklet

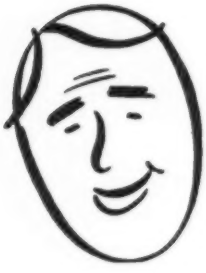
A new 28 page booklet, "Superior Stationary Diesel Engines" is just off the press. It's packed with facts that tell *how, when and why* Superior Diesel Engines can help you build profits. Write for your free copy today.

THE HIGH COST OF BACK-PRESSURE: $21000/year

Just exactly how high the cost of back-pressure really is was recently proved in a Southern power station. Slime-fouling on condenser water side surfaces accumulated between plug cleanings to build back-pressure up from approximately 0.6" to a maximum of 1.1". That extra back-pressure on a 30000 KW base load unit *boosted* steam consumption an average of 7500 pounds per hour. At a cost of about $0.34 per thousand pounds and with the turbine operating 24 hours per day 350 days per year, the cost of back-pressure figures out to be $21000 per year.

THE LOW COST OF CORRECTION: $5000/year

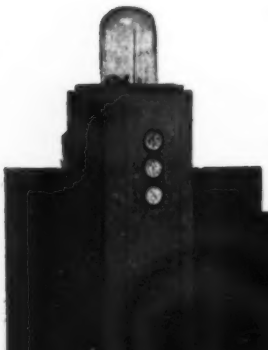
Chlorination applied through the W & T De-Sliming Process, at a total annual cost of approximately $5000 including amortization and all operating expenses kept the condensers slime-free, eliminated the need for plug cleaning and reduced equipment outage time.



NET $AVINGS: $16000/year

Not only did chlorination make operations easier and more effective, but the annual savings in steam alone amounted to $16000 — enough to pay for the investment in less than two years.

Your W&T Representative will be glad to make a study for you—without obligation, of course—to see if you, too, are paying the high cost of back-pressure.



CD-26

WALLACE & TIERNAN PRODUCTS, INC.

Manufacturers of Chlorine and Ammonia Control Apparatus

Belleville 9, New Jersey • Represented in Principal Cities

TURBINES at World's Largest Mechanical Treatment Sewage Plant

safeguarded from dirt and water

DE LAVAL Oil Purifiers keep the turbine oil free from harmful impurities at Southwest Works, Sanitary District of Chicago. Centrifugal force frees the turbine oil of both troublemakers — ***dirt*** and ***water***. Turbine oil at this large plant is continuously purified and hence always in condition to give maximum protection to the power units in the plant.

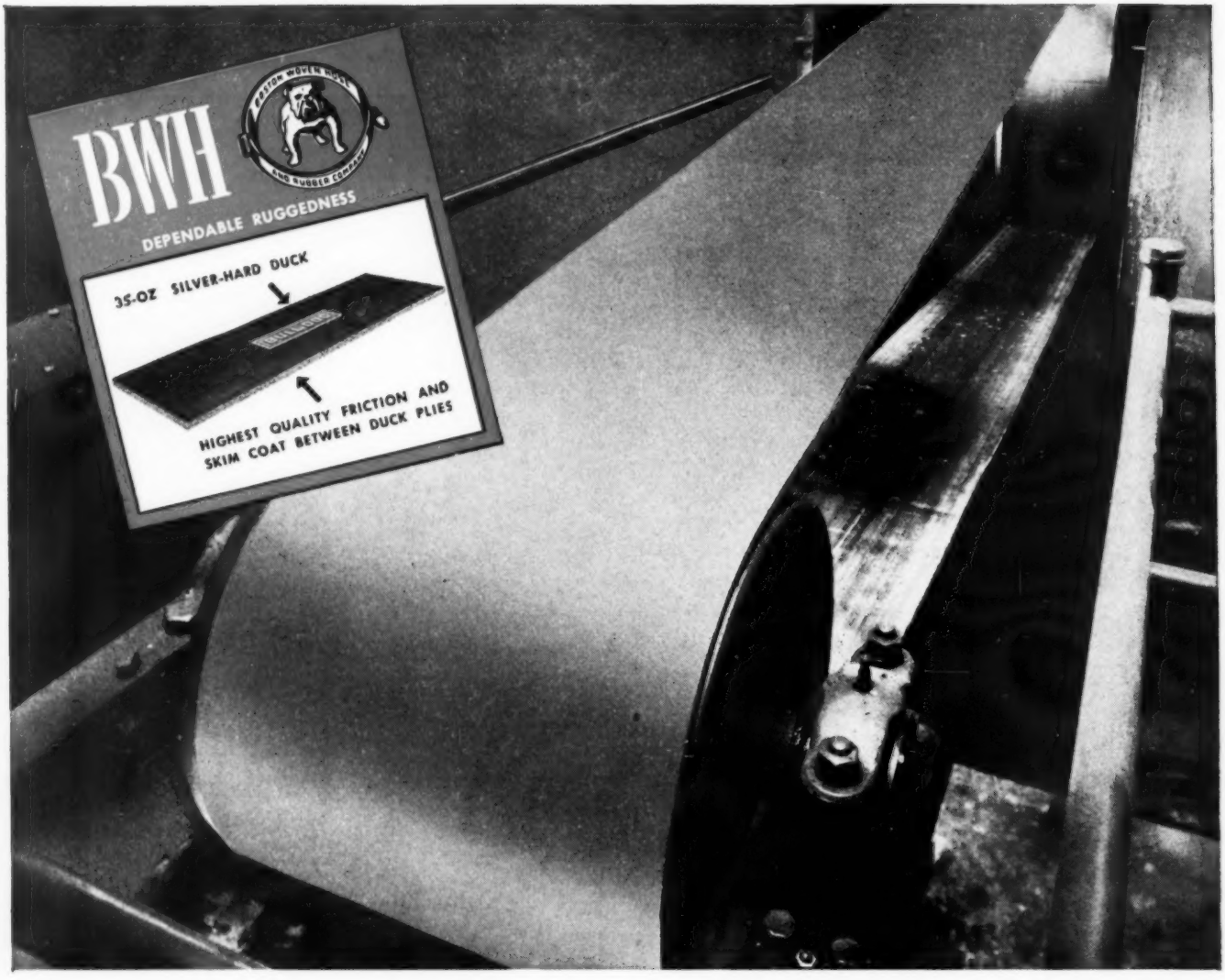
In power plants of all sizes, a De Laval Oil Purifier is the most effective turbine oil maintenance unit. Dirt and water are thrown out of the oil by centrifugal force, the water being continuously discharged, the dirt collecting in the bowl, outside of the zone of purification. With a De Laval centrifugal machine, the efficiency of purification is as high at the end of a run as at the ***beginning***.

Write for Bulletin 400. Free.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL OIL PURIFIERS

for more dependable power production



JUST KEEPS ROLLIN' ALONG

another top performance by a BWH product

Day in, day out, for over fifteen years, this tough BWH Bull Dog Transmission Belt has been steadily at work in one of America's great industrial plants. That's a record to talk about, but it isn't unusual for BWH Belts.

Made by the famous ROTO-CURE process of continuous vulcanization, these famous belts have long life and trouble-free performance built into every inch. Because potential trouble spots caused by press overlaps are entirely eliminated and the belt is uniformly stretched throughout its entire length, extra service is assured.

Under high stress, difficult operating conditions and on peak load starting, this rugged BWH Belt proved it could stand the gaff.

The success stories of Bull Dog Transmission Belts are matters of record in ore-crushing, refinery, paper, lumber and textile industries . . . to mention only a few. Whatever your needs for industrial rubber goods, look to BWH for dependable ruggedness . . . and to BWH distributors for dependable service!

' ' '

HAVE YOU A JOB WHERE STAMINA COUNTS?
Bring us your toughest problems . . . we're specialists in solving them. Consult your nearest BWH distributor, or write us direct.

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all principal cities

PLANT: CAMBRIDGE, MASS., U.S.A. • P.O. BOX 1071, BOSTON 3, MASS.

Automatically

• • • cut in a boiler

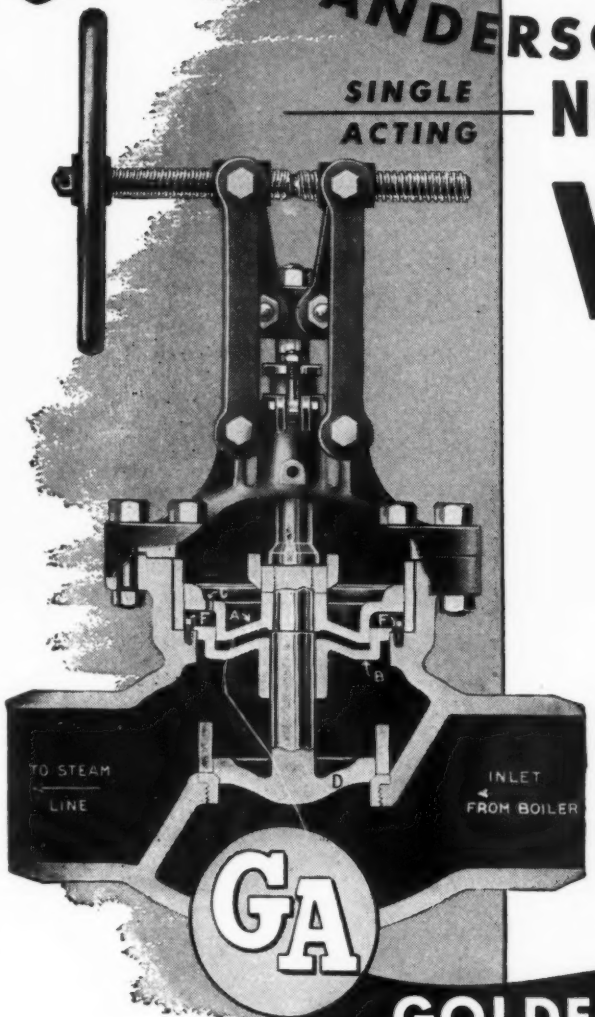
• • • isolate a boiler

For absolute, dependable safety—choose GOLDEN-ANDERSON Non-Return Valves—they will automatically isolate a damaged boiler against reverse steam flow as well as closing down steaming boilers due to ruptured steam line or header beyond the valves.

GOLDEN-ANDERSON

SINGLE ACTING — **NON-RETURN**

VALVES



Available in series 600, 900, and 1500. Regular sizes from 2½ inch to 14 inch in Angle, Globe and Elbow Patterns; Special Sizes and Cross Pattern also available. Valves may be piped to any convenient boiler room station and by exhausting pressure from annular space between valve dashpots cause valve to close and thus prove it operative and reliable for any emergency operation.

Engineering Aid

For any problem involving high or low pressure, to meet practically any service requirement—call on GOLDEN-ANDERSON engineers.

GOLDEN-ANDERSON
VALVE Specialty Company
KEENAN BUILDING · PITTSBURGH 22, PA.

Other GOLDEN-ANDERSON Automatic **VALVES**

- Emergency Trip Valves
- Altitude Control Valves
- Pressure Reducing Valves
- Coke Quenching Valves
- Throttle and Automatic Engine Stop Valves
- Over 1500 Types and Sizes for Safe, Dependable Flow Control

How much are you spending on STEAM?

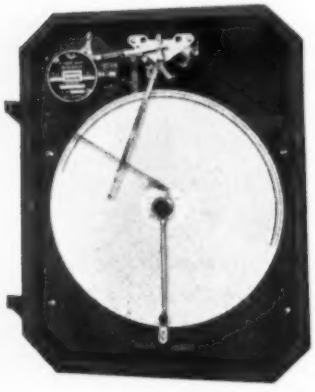
PERHAPS your company is losing money on excessive steam consumption in various departments due to faulty operation of traps or valves. At any rate, you can't cut steam costs without first figuring them out. And that's just what the new Taylor Integrating (Aneroid or Mercury) Flow Meters can do for you with dependable accuracy.

First the Manometer precisely measures the rate of flow. Then the Taylor Square Root Integrator accurately *totalizes* the flow of liquids, and of gases and steam under constant pressure. For instance, this versatile Taylor instrument keeps the exact total of steam consumption throughout your building at your fingertips.

The Square Root Integrator is easy to read through a large (2-inch) window in the case door. Dependable, synchronous motor drives counter thru positive clutch without the use of ratchets. Continuous check on accuracy of calibration at any point of range. Both Oilite and ball bearings for long life. Few moving parts; permanently lubricated cam rollers, self-lubricated bushings; positive, oil-proof counter clutch.

▾ ▾ ▾

For full details, ask your Taylor Field Engineer. Also ask him about the new Taylor Aneroid (mercury-less) Manometer, with no mercury, no pivots, no stuffing box! Nothing to replace or wear out. Write for Catalog 98175. Taylor Instrument Companies, Rochester, N. Y., or Toronto, Ontario.



Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.

Taylor Instruments

MEAN

ACCURACY FIRST

IN HOME AND INDUSTRY

70 years

We hesitate to prattle of yesterday but how else are we to emphasize that "Experience is the Best Teacher"? How else can we demonstrate that our acquired knowledge over a period of three score and ten years is still working for us here at Jeffrey? By having this heritage of years in the design, building and installation of material handling, mining and processing systems we think we are more qualified by experience to offer reliable cost reduction information today . . and tomorrow. Explore Industry on your own . . find out for yourself why Jeffrey equipment enters into so many modern programs . . why it has been selected on so many important jobs where a speed-up in production and cost reduction are in demand.

We do not do or know everything . . not by a long shot. But we are still trying after seventy years . . still promoting production efficiency for that long pull ahead. Jeffrey wants to help you and stands ready to place a rich experience at your disposal.

THE JEFFREY MANUFACTURING COMPANY

932-99 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

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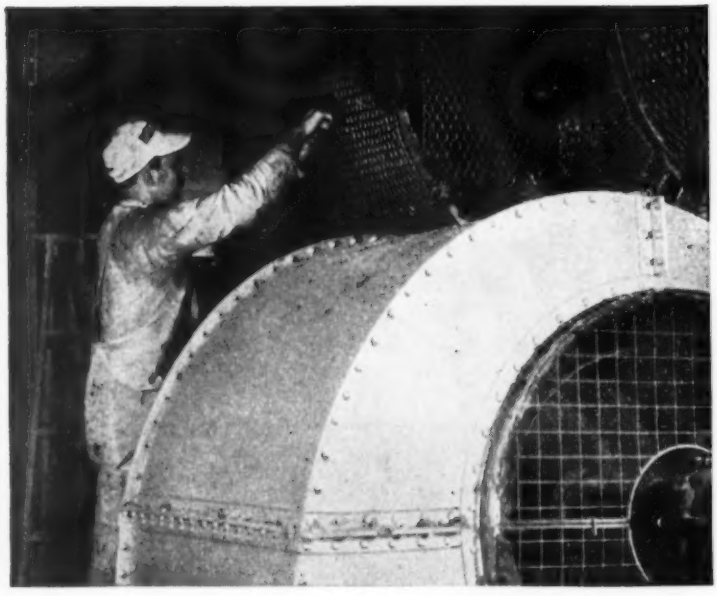

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to you, with
EAGLE-PICHER
Insulations

Eagle-Picher Super "66" Insulating Cement

All-purpose . . . for permanent efficiency

"Springy Ball" pellets of Eagle-Picher Mineral Wool contain thousands of minute dead air cells that give Super "66" tremendous insulating efficiency. These pellets retain their form even after the insulation dries, to preserve permanently extremely low thermal conductivity. In addition, Super "66" actively inhibits rust on metal equipment. It's all-purpose, sticks to any shape surface, and withstands temperatures up to 1800 F. Complete technical and application data on request.

Let these Eagle-Picher products also save you money . . . power . . . time

Insulating Felts
Supertemp Block • Blankets
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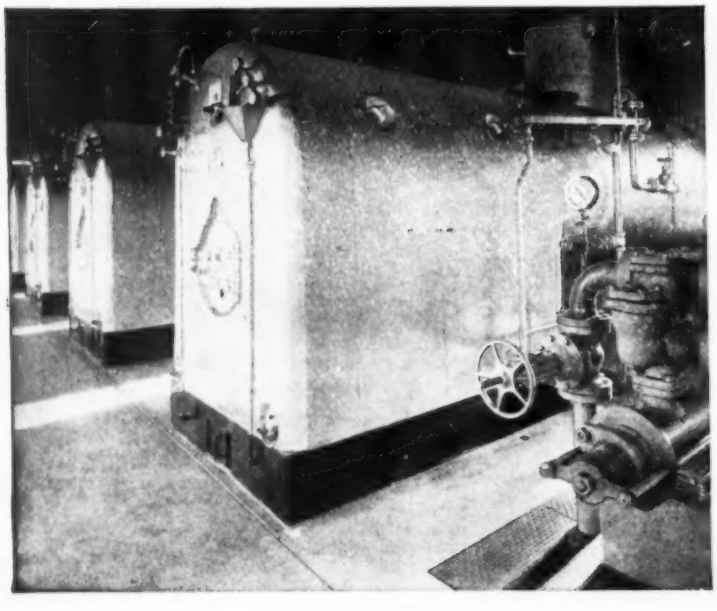
Insulating Cements



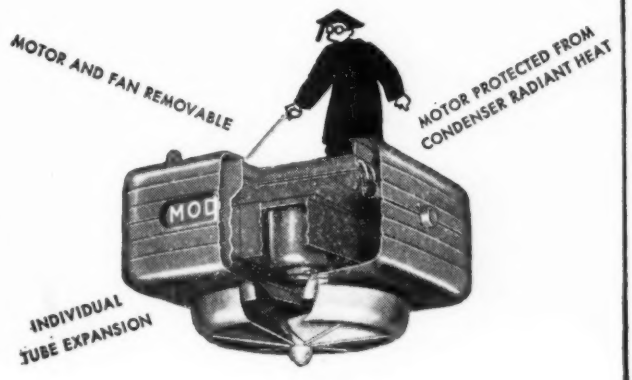
EAGLE-PICHER INSULATIONS for

EAGLE EP PICHER

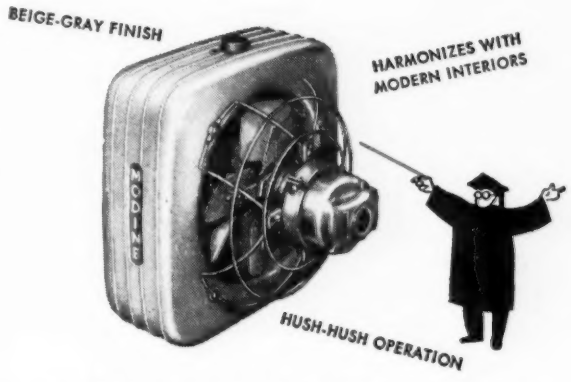
High and low temperature

Since 1843
THE EAGLE-PICHER COMPANY
CINCINNATI (1), OHIO

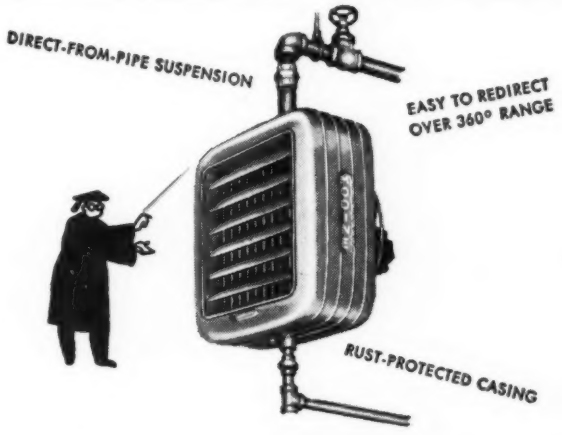
What's the Formula for the Best in Unit Heaters?



1. *Take top quality coils.* You get one-piece, brazed construction, red brass tubes and copper fins in new Modine design. That means greater strength, longer life, continuous high heat transfer, better performance, even after years of operation!



2. *Add smooth air distribution.* Modine scientifically designed venturi inlet, velocity generator and adjustable, curved deflector blades give you uniform, quiet heat delivery, positive penetration of cold air strata near floors.



3. *Plan on easy installation.* Forget about expensive supports, extra labor costs with Modine. Patented center supply and return connections mean unit can be suspended directly from supply line with complete safety, installation savings up to $10 per unit.

4. *Choose the right heat pattern.* Modine's flexible heat delivery gives you even temperatures, precisely controllable for perfect comfort, low cost. Like light, you can beam, flood, or gently diffuse heated air where and when you want it.

RESULT: The Quality Unit Heater for your Needs!

Modern, streamline Modine unit heaters are easy on the eyes and ears — and your pocketbook too! 47 basic capacities mean the right unit for any application. 1) Horizontal Delivery Types for general industrial applications. 2) Vertical Delivery Types for overhead installation. 3) Power Throw Types for special high velocity use. Look for Modine's representative in the "Where-to-Buy-it" section of your phone book, or send in coupon at right.

Modine UNIT HEATERS

MODINE MANUFACTURING CO.
1512 Dekoven Ave.
Racine, Wisconsin

Yes! I want all the facts about Modine's integrated Unit Heater Line. Please send me complete information.

NAME .....

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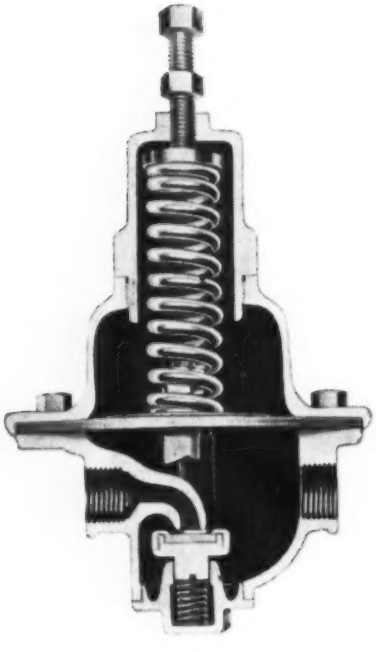
IT'S THE RULE

instead of the exception...

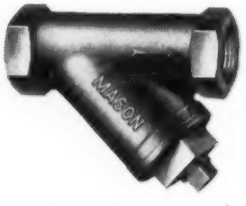
MASONEILAN REGULATORS

Reduce Costs with Long-Lived Performance!



No. 414 for Air Service. Other Masoneilan Pressure Reducing Regulators are available for water, steam and air.

You can count on Masoneilan Regulators to save you money because they accurately control pressure, reduce waste and minimize time-out of service. In addition, such advantages as ease of adjustment, rugged construction and low maintenance assure reduced costs.



MASONEILAN STRAINERS

Use these strainers to prevent scale, dirt, chips, etc., from damaging regulators, traps, valves and pumps. These strainers keep out all foreign matter. They eliminate maintenance delays and thus save money.

MASONEILAN EQUIPMENT STOCKED BY:

Allen & Reed, Inc., Providence, R. I.
Appleby Bros. & Whittaker, Harrisburg, Penna.
Atlantic Pipe & Supply Co., Boston, Mass.
Babbitt Steam Specialty Co., New Bedford, Mass.
Barclay Ayers & Bertsch Co., Grand Rapids, Michigan
Barrett-Christie Co., Chicago, Ill.
Berkshire Mill Supply, Pittsfield, Mass.
W. L. Blake & Co., Portland, Me.
Boston Pipe & Fittings Co., Cambridge, Mass.
Braman Dow & Co., Boston, Mass.
Burns Bros., Syracuse, N. Y.
Carolina Supply Co., Greenville, S. C.
Central Supply Co., Fresno, Calif.
Chandler-Boyd Co., Pittsburgh, Penna.
Coblentz Equipment Co., Erie, Pa.
Columbia Supply Co., Columbia, S. C.
The Condit Co., Tulsa, Oklahoma
Coon-De Visser Co., Detroit, Mich.
M. J. Daly & Sons Inc., Waterbury, Conn.
Desco Corp., Wilmington, Del.
Dillon Supply Co., Durham & Raleigh, N. C.
J. E. Dilworth Co., Jackson, Miss.
J. E. Dilworth Co., Vicksburg, Miss.
J. E. Dilworth Co., Memphis, Tenn.
Dixie Mill Supply Co., New Orleans, La.
Morton McI. Dukehart, Baltimore, Md.
Evansville Supply Co., Evansville, Ind.
Fall River Steam & Gas Pipe Co. Corp., Fall River, Mass.
Fleming & Moore Supply Co., Savannah, Ga.
Fuchs Machinery & Supply Co., Omaha, Nebr.
Galloup Pipe & Supply Co., Battle Creek, Mich.
Galloup Pipe & Supply Co., Jackson, Michigan
Galloup Pipe & Supply Co., Kalamazoo, Mich.
Grinnell Co., Inc., Cleveland, Ohio
Grinnell Co., Inc., Cranston, R. I.
Grinnell Corp., Atlanta, Ga.
Hajoca Corp., Chattanooga, Tenn.
Hamacher & Williams, Milwaukee, Wis.
Hardware & Supply Co., Akron, Ohio
Hollis & Co., Little Rock, Ark.
Holyoke Valve & Hydrant Co., Holyoke, Mass.
Indianapolis Belting & Supply Co., Indianapolis, Ind.
E. Keeler Co., Williamsport, Pa.
The Knapp Supply Co., Muncie, Ind.
Laib Co., Louisville, Ky.
Laib Supply Co., Louisville, Ky.
Lang Co., Salt Lake City, Utah
Maintenance Engineering Corp., Houston, Texas
Marsden & Wasserman, Inc., Hartford, Conn.
Mason Equipment Co., Toledo, Ohio
James McGraw, Inc., Richmond, Va.
The C. S. Mersick & Co., New Haven, Conn.
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Chas. Millar & Son Co., Binghamton, N. Y.
Chas. Millar & Son Co., Springfield, Mass.
Chas. Millar & Son Co., Utica, N. Y.
Montgomery & Crawford, Inc., Spartanburg, S. C.
J. J. Morin Inc., Laconia, N. H.
Noland Co., Roanoke, Va.
O'Brien Equipment Company, St. Louis, Mo.
W. M. Pattison Supply Co., Cleveland, Ohio
Pennypacker Supply Co., Philadelphia, Penna.
Henry A. Petter Supply Co., Paducah, Ky.
Portland Engineering Co., Portland, Oregon
Reichle Supply Co., Saginaw, Mich.
R. I. Supply & Engineering Co., Providence, R. I.
Root-Neal & Co., Buffalo, N. Y.
The Ross-Willoughby Co., Columbus, Ohio
The Ross-Willoughby Co., Springfield, Ohio
San Antonio Machine & Supply Co., San Antonio, Texas
Savannah Ship Chandlery & Supply Co., Savannah, Ga.
Smith-Courtney Co., Greensboro, N. C.
Smith-Courtney Co., Hickory, N. C.
Smith-Courtney Co., Richmond, Va.
Smith-Monroe Co., South Bend, Ind.
Thos. Somerville Co., Washington, D. C.
Spurgeon & Smith Co., San Francisco, Calif.
Steam Supply & Rubber Co., Seattle, Wash.
Stritt & Priebe, Inc., Buffalo, N. Y.
The Textile Mill Supply Co., Charlotte, N. C.
Trimble & Lutz Supply Co., Wheeling, W. Va.
The Henry Walke Co., Norfolk, Va.
Walworth Co., Boston, Mass.
Warren & Bailey Co., Los Angeles, Calif.
Washburn-Garfield Co., Worcester, Mass.
Woodward, Wight & Co., Ltd., New Orleans, La.
Wyckoff & Lloyd Co., Springfield, Mass.
The Young & Vann Supply Co., Birmingham, Ala.

MASON-NEILAN REGULATOR CO.

1186 ADAMS STREET, BOSTON 24, MASS.

MASONEILAN

New York Chicago St. Louis Philadelphia
Houston Buffalo Pittsburgh Tulsa
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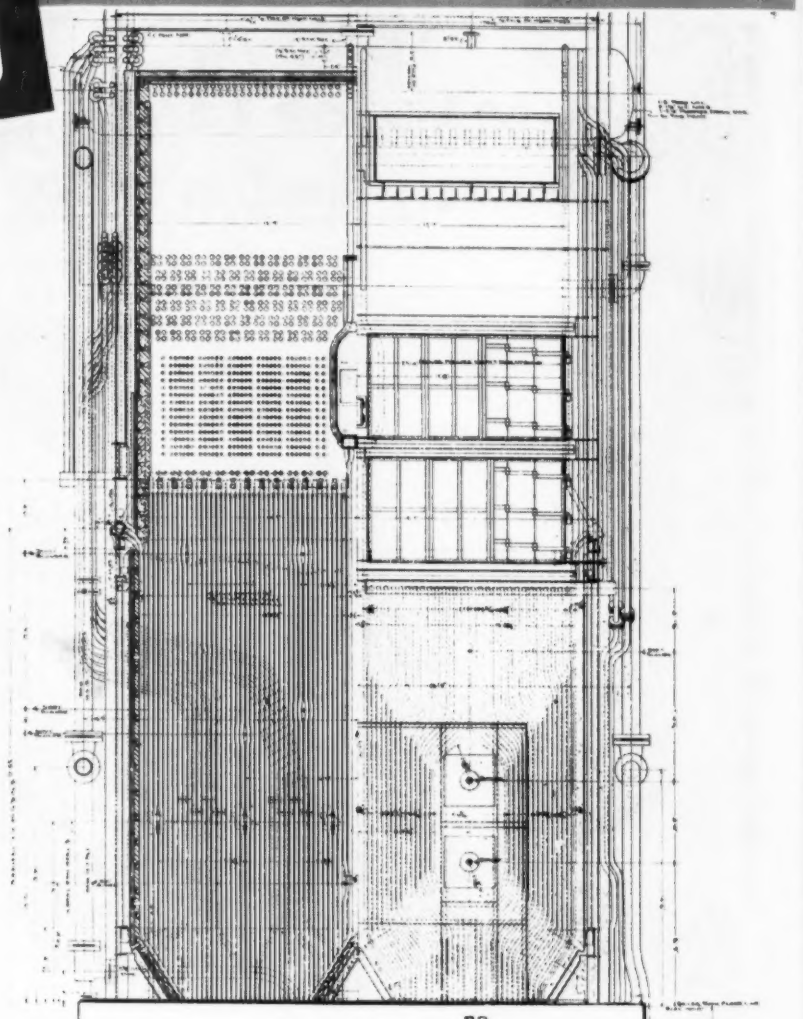
Mason Regulator Co. of Canada, Ltd.
Montreal and Toronto

Offered by SPRINGFIELD

THE DIVIDED FURNACE WITH CENTER WATER WALL



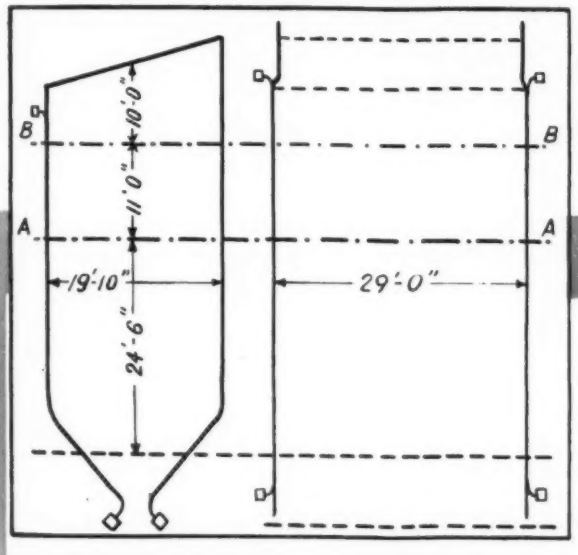
THE divided furnace with a CENTER WATER WALL* is a development first introduced by Springfield Boiler Co., in central station installations. It has application in any larger unit where gas temperatures entering the first pass and superheater must be limited, across the full width of the boiler. It offers important opportunity to limit furnace temperatures, enabling the unit to stay on the line longer before coming off for maintenance and cleaning – slag removal, in particular.

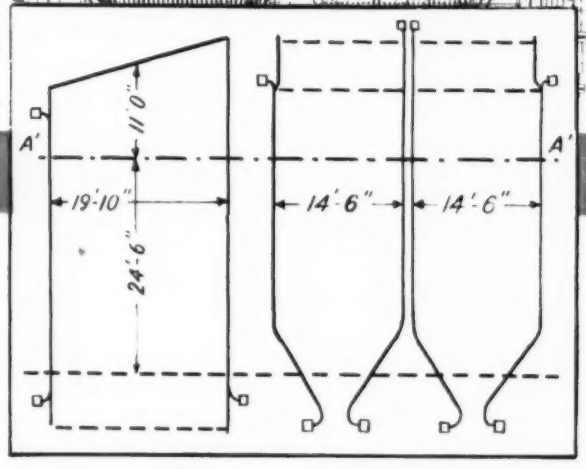
The divided furnace construction has been highly dependable and successful in service. It is adaptable to any kind of firing. Springfield offers it on both bent tube and straight tube boiler designs.

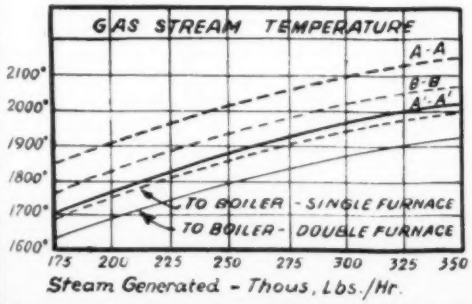
** Patented*

For information write to

SPRINGFIELD BOILER CO.
1953 E. Capitol Avenue
Springfield, Illinois
Worldwide Sales and Service



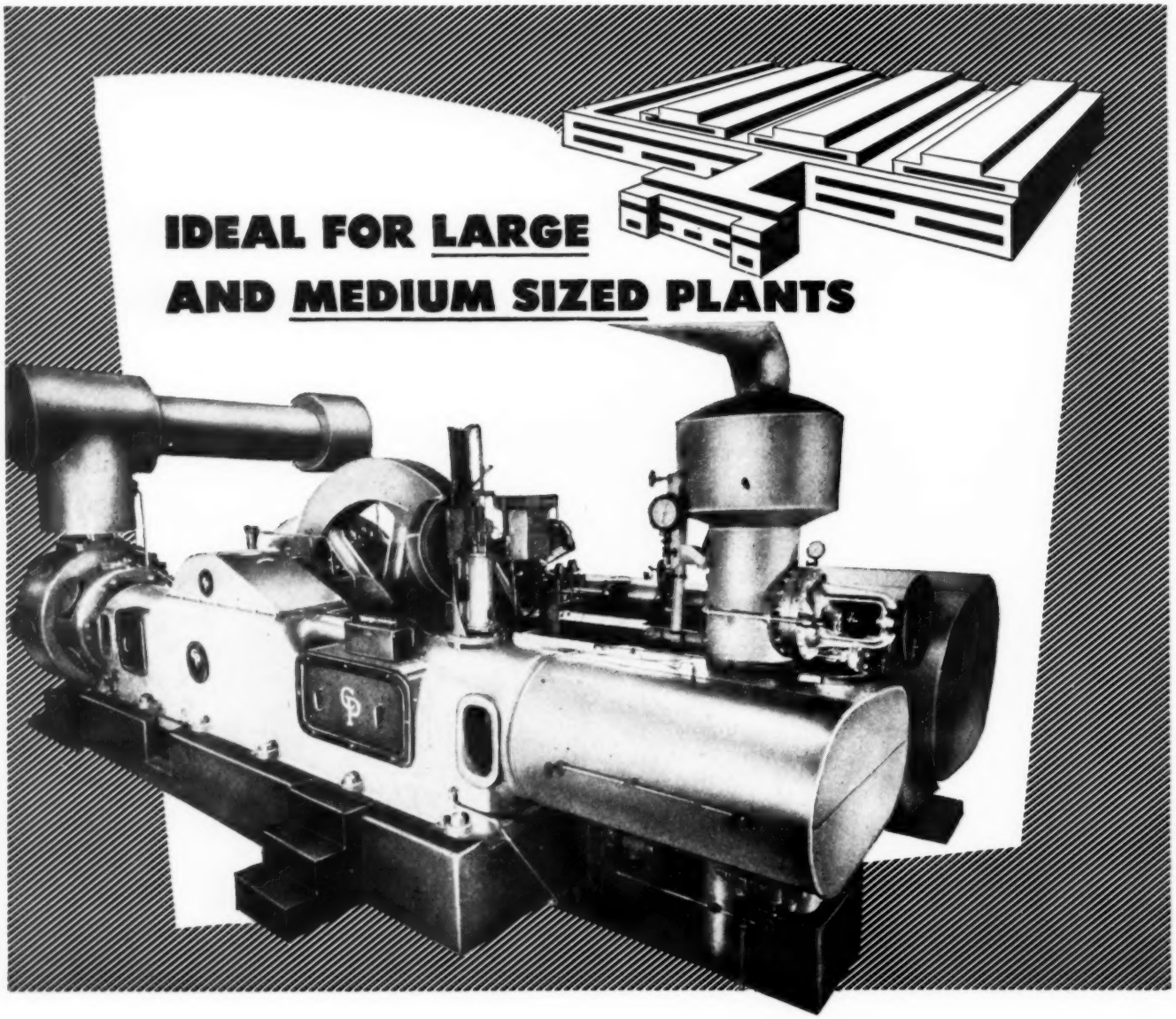




A Comparison

The schematic drawing at the left above shows the size of a conventional single furnace needed for a given boiler* operating at 675 psi. The diagram above shows the size of the double furnace needed for the same boiler. Height above line B-B is that added to bring gas below slagging temperature in single furnace; otherwise, furnace volume is the same. The curves at the left show a comparison of temperatures at center of gas stream.

** Location on request*



CP HORIZONTAL DUPLEX STEAM-DRIVEN COMPRESSORS

In plants having ample boiler capacity, CP Steam-Driven Compressors provide a most effective and economical means of meeting air demands – while the exhaust steam may be utilized for heating or process work.

Capacities of these Chicago Pneumatic duplex steam-driven compressors range from 900 to 6600 c.f.m., 100 to 125 pounds air pressure, with steam cylinders available for a wide range of steam conditions. Other sizes of the CP Steam-Driven Compressors available in single and multi-stage designs for lower and higher pressures. Write for literature.

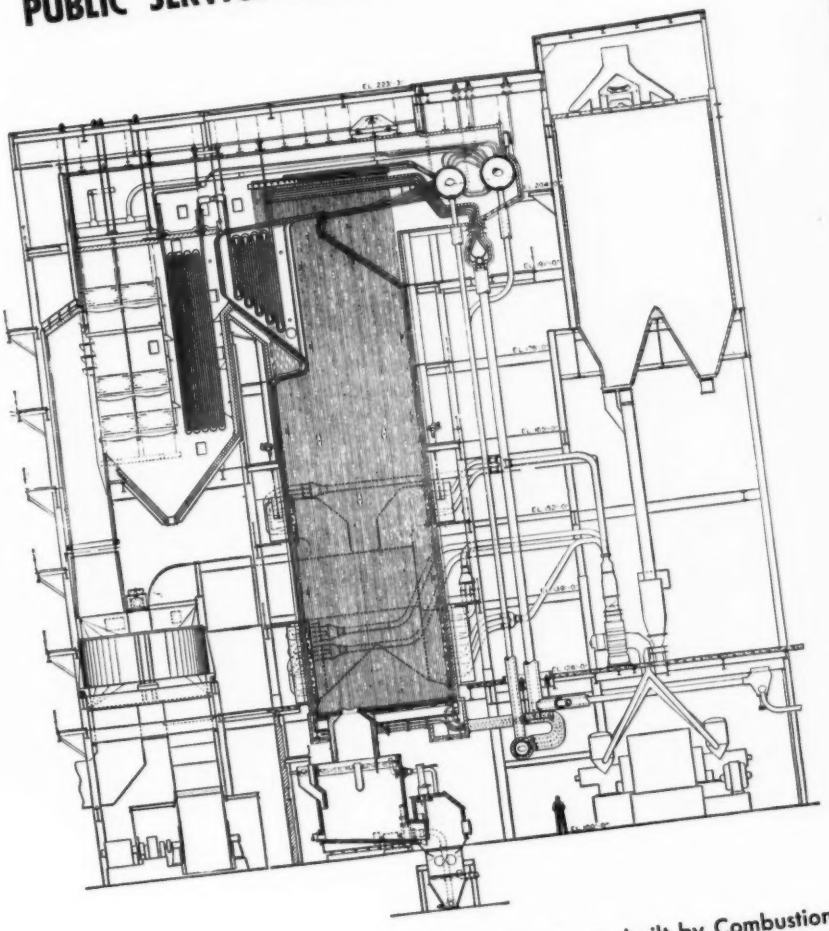
CHICAGO PNEUMATIC TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

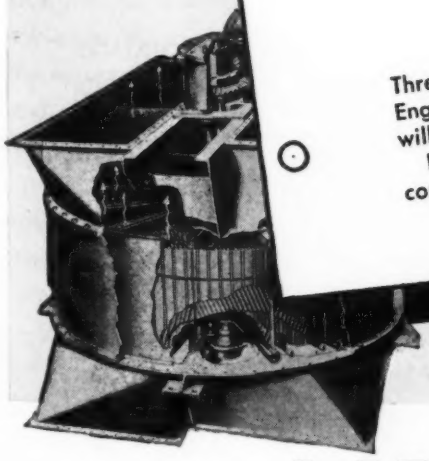
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

ENGINEERING PROGRESS REPORT #16

LJUNGSTROM AIR PREHEATER

THREE NEW 850,000 LB. PER HOUR BOILERS FOR PUBLIC SERVICE ELECTRIC AND GAS CO.





Three new 850,000 lb. per hour boilers are being built by Combustion Engineering Co., Inc., for Public Service Electric and Gas Company. They will be used in the new power station at Sewaren, N. J.

Each boiler is equipped with two Ljungstrom Air Preheaters, maximum-continuous-load exit gas temperature 300 F.

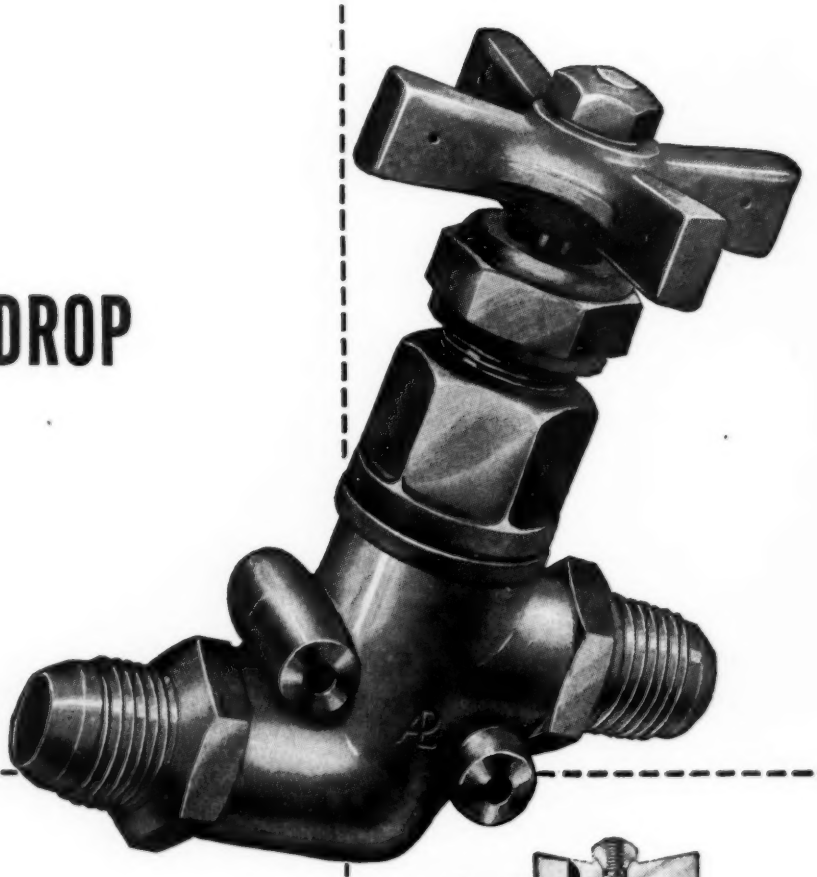
THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.

CUT PRESSURE DROP 50%!



Operating tests prove you can reduce pressure drop in your hydraulic or fluid transmission systems by installing PARKER Globe Valves.

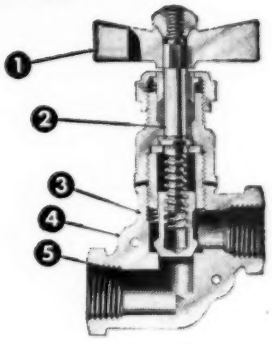
The secret is free flow. The offset body design eliminates pockets and intricate chambers that trap liquids and gases. The result is smoother flow—less turbulence—and less pressure drop—by as much as 50%.

PARKER Needle Valves also keep pressure drop low. You can install these Globe and Needle valves directly into the circuit. Models are available in various combinations of tube ends and pipe threads, thus eliminating awkward adapters that block flow—add weight—and take up valuable space.

If you're interested in pressure-tight systems for moving liquids and gases, you'll want more information about these *precision*-made PARKER Valves. Write for Bulletin A52.

THE PARKER APPLIANCE COMPANY
17325 Euclid Avenue · Cleveland 12, Ohio
Plants: Cleveland and Los Angeles
Offices: New York, Cleveland, Chicago, Los Angeles, Dallas, Atlanta
Distributors in Principal Cities

Parker
TUBE FITTINGS • VALVES



WHY PARKER GLOBE VALVES GIVE TROUBLE-FREE SERVICE

1—Prong handle provides easy grip.

2—Stem is non-rising type—permits easy installation where space is limited.

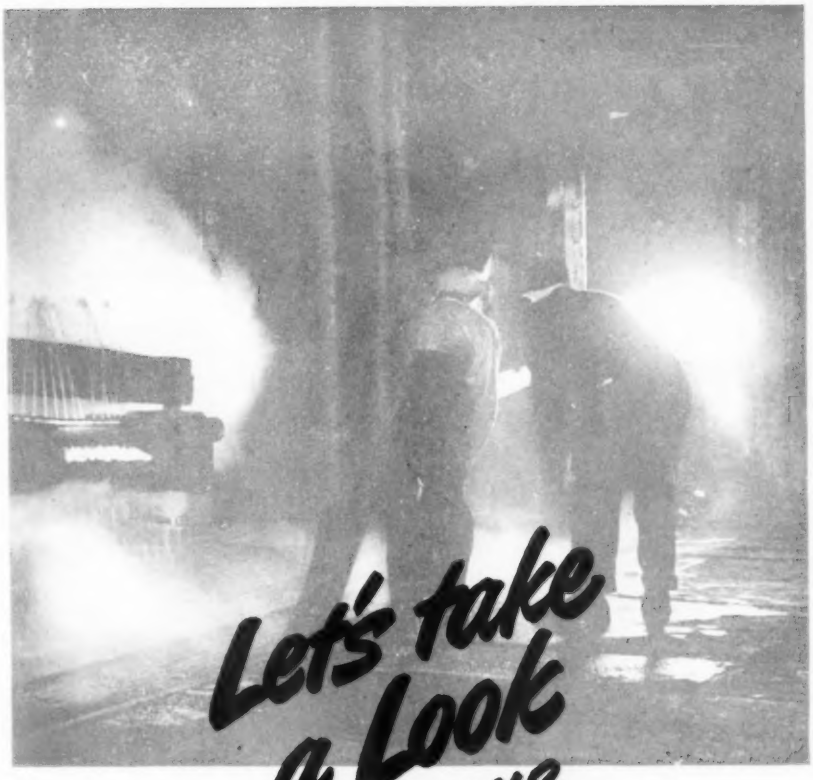
3—Forged brass body is small, flat, thin, strong.

4—Mounting lugs are forged into the body.

5—Offset design provides smooth, free flow.

★

PARKER offers manufacturers a complete line of precision-made industrial valves for small diameter tubing systems.



HEAT PROBLEMS

Take a minute to think back over your big power cable repair jobs. How many of them were necessary because wiring couldn't stand the struggle with ambient heat — because power cables were no match for the temperatures they had to meet?

For those problem jobs — for those jobs where heat is a constant threat — look into the dollar-saving, timesaving advantages of Deltabeston* power cables. They're real heat beaters, built to cut maintenance costs around hot installations like furnaces, soaking pits, and hot strip mills. For boiler rooms and other applications where a combination of heat and moisture must be beaten, there are special Deltabeston types to do the job.

Whatever your heat problem may be, there's a Deltabeston power cable that will solve it. Insulated with felted asbestos and sheathed in asbestos braid or lead, Deltabeston power cables are made to fight heat and operating abuse.

Your General Electric merchandise distributor is always ready to give you help in matching Deltabeston power cables to your specific requirements — or, if your problem is unusual, to put you in touch with a field specialist on heat-beating wires and cables. For further information, write to Section Y97-1163, General Electric Company, Bridgeport 2, Connecticut.

*Trade-mark Reg. U. S. Pat. Off.

HI-AMBIENTS

Application Hints from Your Deltabeston Distributor

When the thermometer blows its top, something's sure to happen to wiring if it's not selected to beat the heat. For extra-high heats, General Electric offers a line of silicone-treated cables that stay on the job at temperatures as high as 200 C (392 F). These silicone-treated Deltabeston cables were developed for infrared oven use, and are now available to help you beat the heat in 300- and 600-volt service.

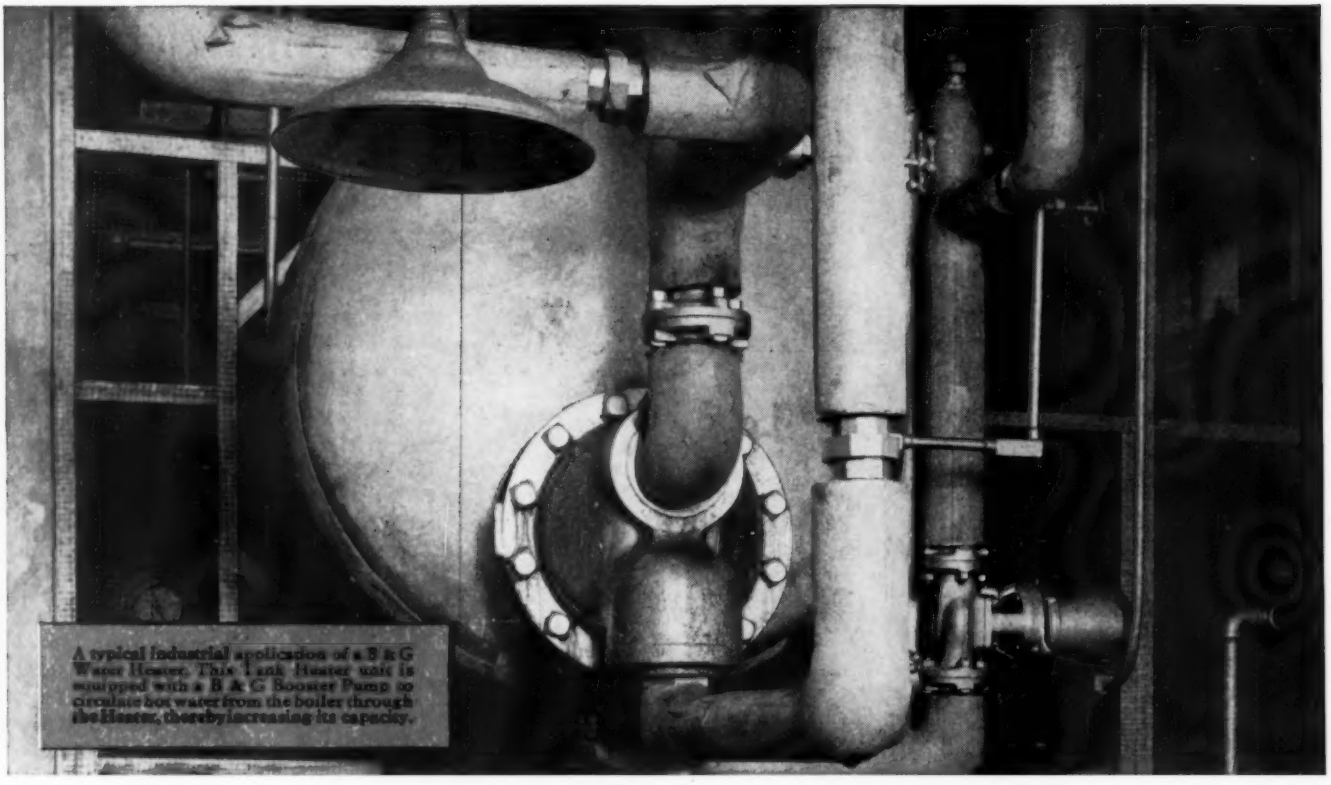
To make your job of selecting heat-beating wires and cords easier, General Electric has prepared a new catalog covering Deltabeston wires and cords for stoves, ranges, appliances, and fixtures. For your free copy, write to Section Y97-1163, General Electric Company, Bridgeport 2, Connecticut, and ask for the *Deltabeston Wires and Cords Catalog.*

Feverish motors can be troublesome when they're not prepared to take high temperatures. But you can prepare them for high-temperature operation with Deltabeston asbestos- or glass-insulated magnet wire. Even the most intricate coils can be formed with Deltabeston, because it's made of flexible, soft copper. It's available in round, square, and rectangular shapes, in sizes to fit all needs. If you do your own motor winding, use Deltabeston magnet wire. If you send your jobs to an outside shop, be sure to specify it.

For assistance on any wiring application where heat is a factor, contact your General Electric merchandise distributor. He'll gladly help you choose the right materials for your job.

DELTABESTON
Power Cable
Built to beat the heat

GENERAL ELECTRIC



A typical industrial application of a B & G Water Heater. This Tank Heater unit is equipped with a B & G Booster Pump to circulate hot water from the boiler through the Heater, thereby increasing its capacity.

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For industrial processing work or for washrooms and showers, the B & G method of heating water keeps costs at rock bottom. B & G Water Heaters transfer heat from water or steam, eliminating the need for a separately fired heater. Design features developed by years of practical experience are assurance of maximum heat transfer, amazingly low operating cost and long life.

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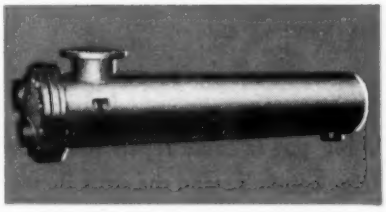
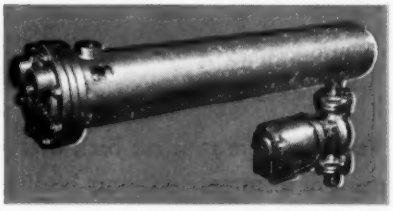
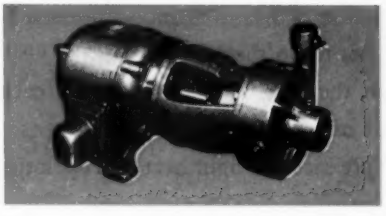


B & G Instantaneous Heater—Type "SU"
For heating water with steam—no storage tank needed. Ideal for industrial plants where large volumes of hot water are continuously required for service water supply or process work.

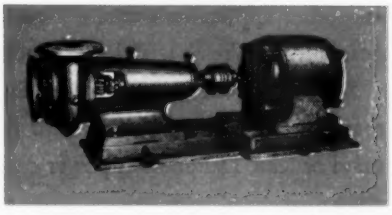


B & G Instantaneous Heater—Type "WU"
Heat transfer in this unit is from water-to-water. Mechanical circulation of boiler water provided by the B & G Booster Pump increases heater capacity and permits accurate control of service water temperature.

TOPS IN CENTRIFUGAL PUMPS



Series 1522
Features a leak-proof Mechanical Seal instead of a stuffing box—standard motors—spring type flexible coupling—interchangeable parts.



Series 1510-1515
Base-mounted, flexible-coupled units with semi-open or enclosed impellers. Accurate machining and mechanical balancing assure quiet operation and peak efficiency.

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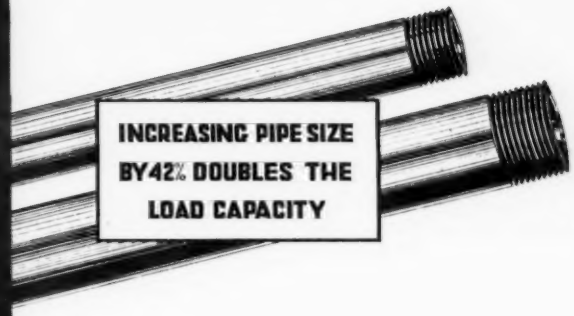
The most expensive pipe to buy ..... is the pipe that's *"just big enough"*



THE wise builder buys steel pipe as an investment for tomorrow, as well as for today. He doesn't figure on the smallest size he can "get by" with. He projects water and steam and other production loads as far into the future as he can, and anticipates his pipe requirements accordingly.

Youngstown would rather supply you with adequately sized steel pipe today, than to sell you undersized pipe now and a replacement job later. Youngstown steel pipe is sold by leading distributors in every market.

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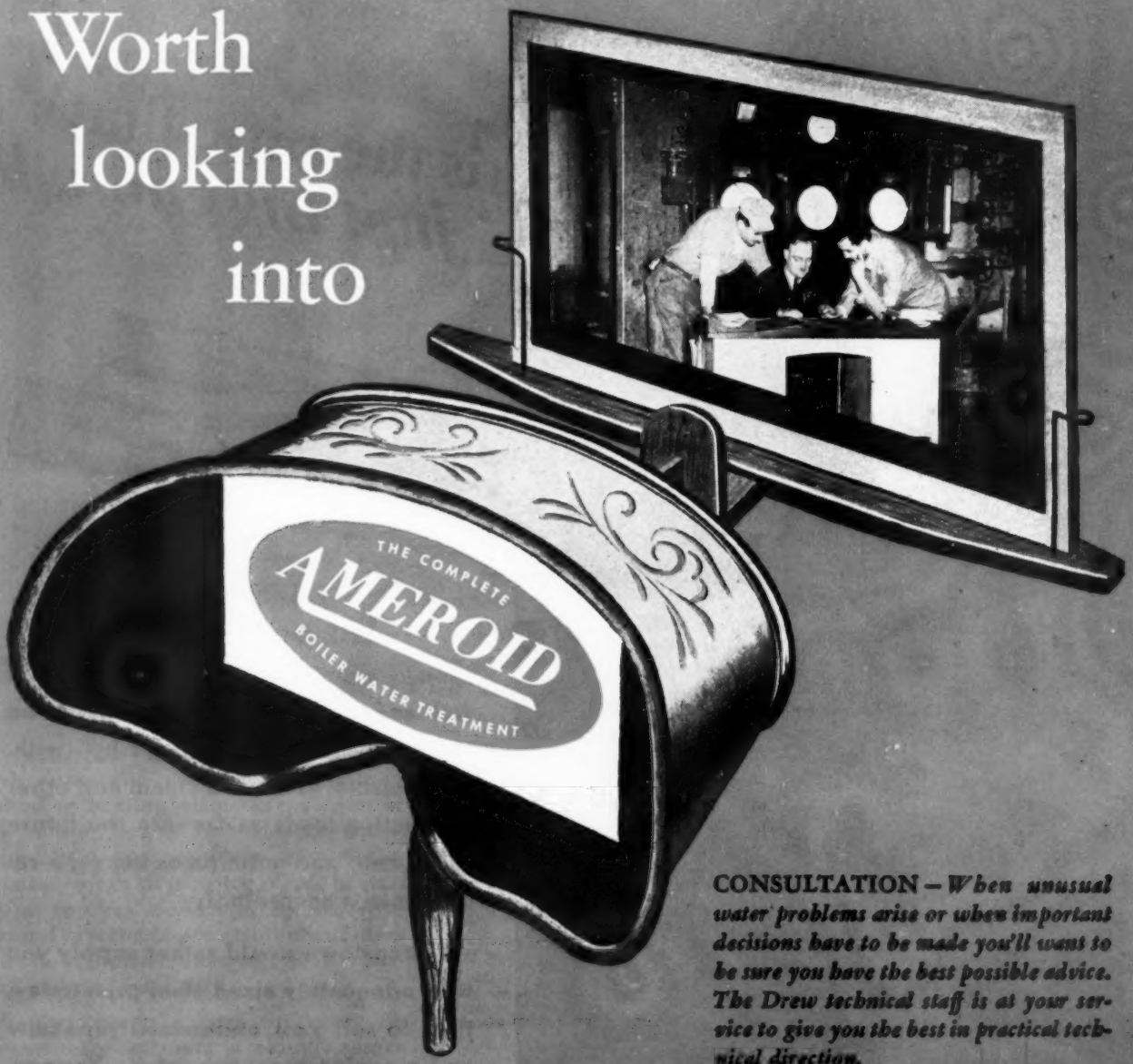

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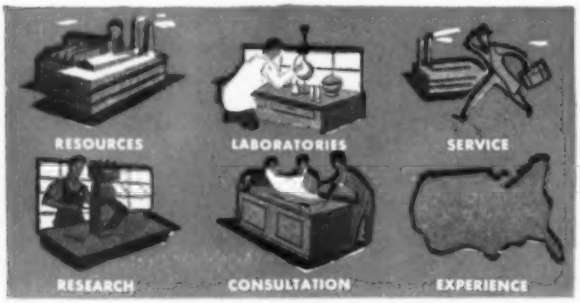

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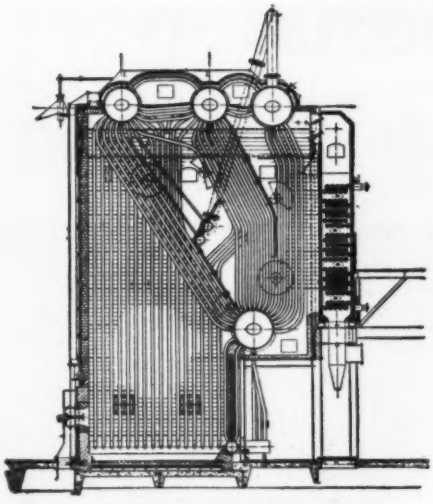
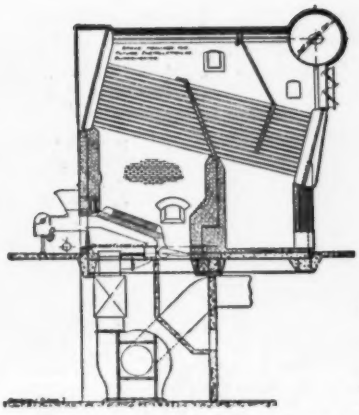
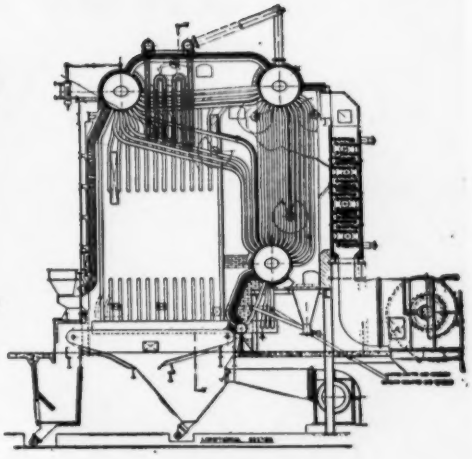


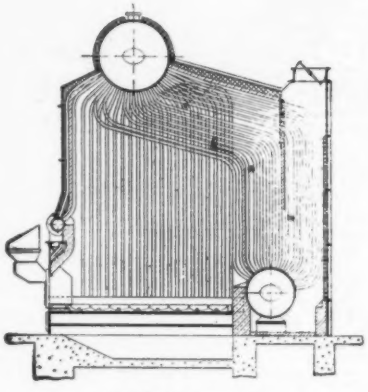
4 Drum Water Tube Boiler



Horizontal Cross or Long Drum Water Tube Boiler



3 Drum "B" Type Water Tube Boiler



Standard 2-Drum Unit

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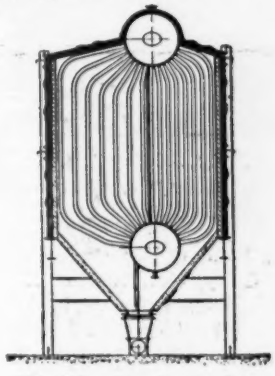
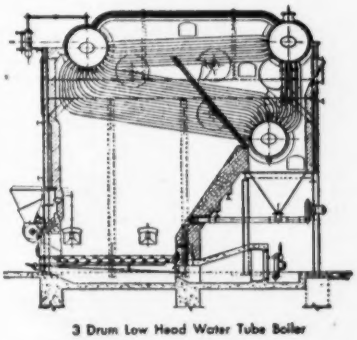
Boilers and pressure vessels designed and manufactured in our plant are converting steam loads into industrial energy in scores of important installations the world over. We have the engineers, manufacturing facilities, and skilled workmen to fill your requirements for boilers of any type up to 250,000 lbs. steam per hour and 850 psi. We also perform all types of heavy welded plate fabrication for oil, chemical, paper, and other industrial use. Send us your problems for expert consultation and recommendation. No obligation, of course.



Wickes 2 Drum Waste Heat Installation



3 Drum Low Head Water Tube Boiler

THE WICKES BOILER COMPANY

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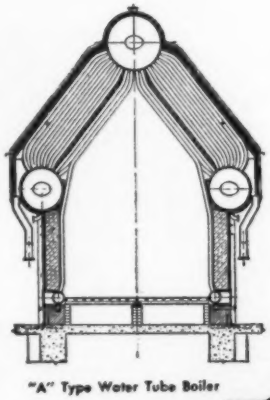
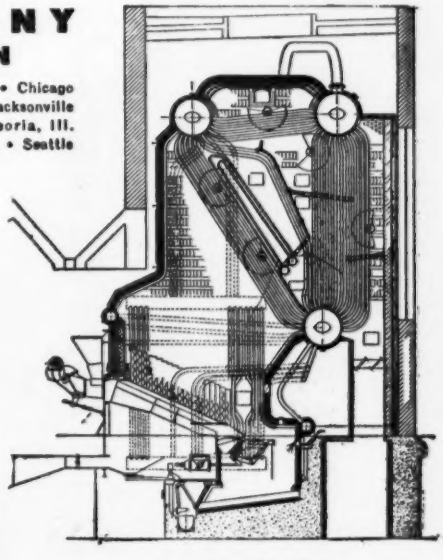
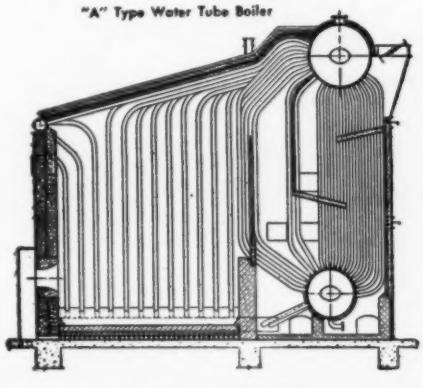


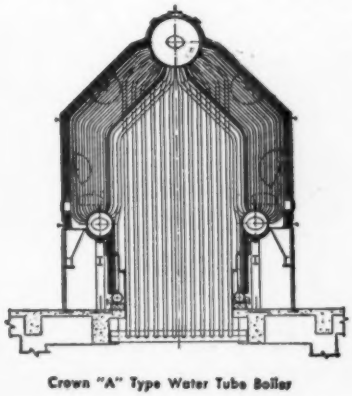
"A" Type Water Tube Boiler



3 Drum Water Tube Boiler



2 Drum Water Tube Boiler



Crown "A" Type Water Tube Boiler

(ADVERTISEMENT)

Power Plant Expansion Requires Varied Pipe Welding

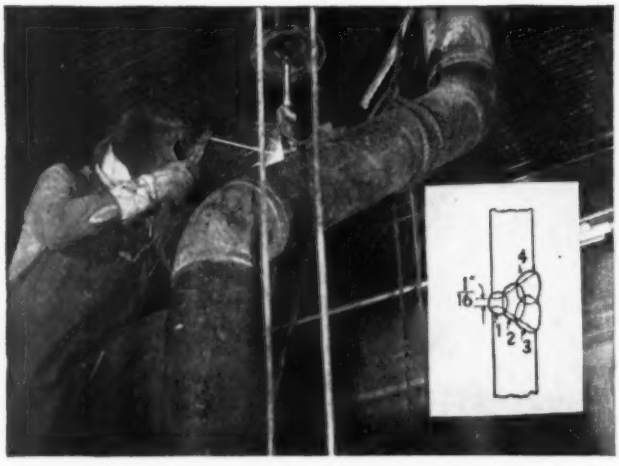


Fig. 1. Welding suspension cylinder to 8" steam line. Pipe joints were welded as shown in sketch.

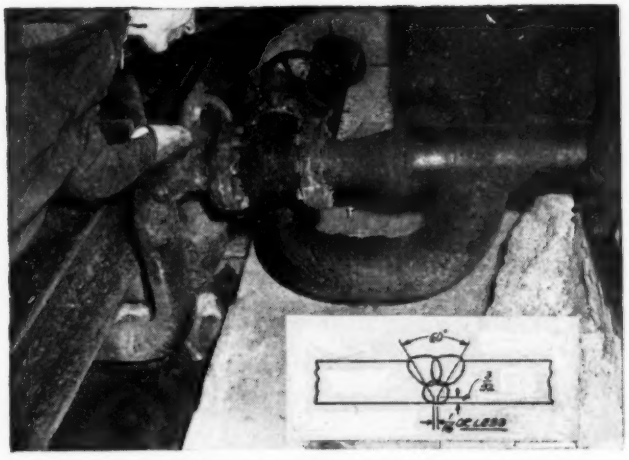


Fig. 2. Welds in these 6" and 4" horizontal pipes were made as shown in sketch.

By William P. Miller, Engineer
Smith & Oby Co., Heating Contractors
Cleveland, Ohio

THE municipal light plant at Painesville, Ohio, is being expanded by the addition of a new boiler and installation of tie-in lines between the various turbo-generators, pumps and boilers for greater flexibility of operation. Main steam lines will carry 600-lbs. pressure.

All pipe connections are being made by arc welding except where valves and equipment have bolted flanges. "Fleetweld 5" electrode is being used.

Fig. 3. Welds in extra-heavy 3" pipe were made in 3 passes.

Fig. 1 shows the welding of the bracket of a spring suspension cylinder to an 8" steam line. This cylinder permits the movement of the pipe caused by an expansion joint below. The elbows are "Tube Turns." These horizontal welds in 8" vertical pipe were made in four passes, as shown in sketch. Pipe ends were bevelled 30°. Stringer pass was made with 1/8" "Fleetweld 5" electrode and subsequent passes with 5/32" size.

Fig. 2 shows a 6" steam line reduced to 4" with a standard taper. Joints in both the 6" and 4" pipe were made according to the standard procedure for vertical welds in horizontal piping (see sketch), using 5/32" electrode for the stringer bead and 3/16" size for second and third passes. Elbows in both 4" and 6" pipe are "Tube Turns." The "fish-mouth" connection of the 6" lines was laid out by the template method and the pipe, flame-cut to the pattern.

Fig. 3 shows the welding of a 45° elbow to a 3" steam pipe. Since this is extra-heavy pipe, three passes instead of the usual two were made, and the sketch in Fig. 2 again applies. 1/8" electrode was used for all three passes.

Fig. 4 shows the bottom of an 8" vertical exhaust line from a warm water storage tank above, with three 4" lines branching off from it. The 1/2" plate on the end of the 8" pipe was welded on with 10 or 12 stringer beads. Joint was bevelled 60° to provide 100% penetration. The drain valve was screwed onto a short length of 2" pipe which was welded to the plate in 3 passes. The 4" pipes were welded to the 8" pipe in four passes, instead of three, for extra strength with 1/8" electrode on the stringer and 5/32" on the remainder. The "fish-mouth" ends of the 4" pipes were laid out to fit the contour of the 8" pipe by the template method.

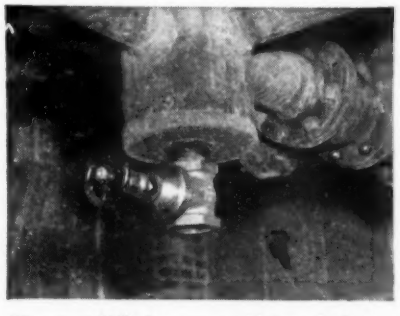


Fig. 4. A 1/2" plate was welded on the bottom of this vertical 8" exhaust line.

The above is published by LINCOLN ELECTRIC in the interests of progress. Specifications and procedures for "Fleetweld 5" electrode are given in Bulletin 403. Write The Lincoln Electric Company, Department 463, Cleveland 1, Ohio.

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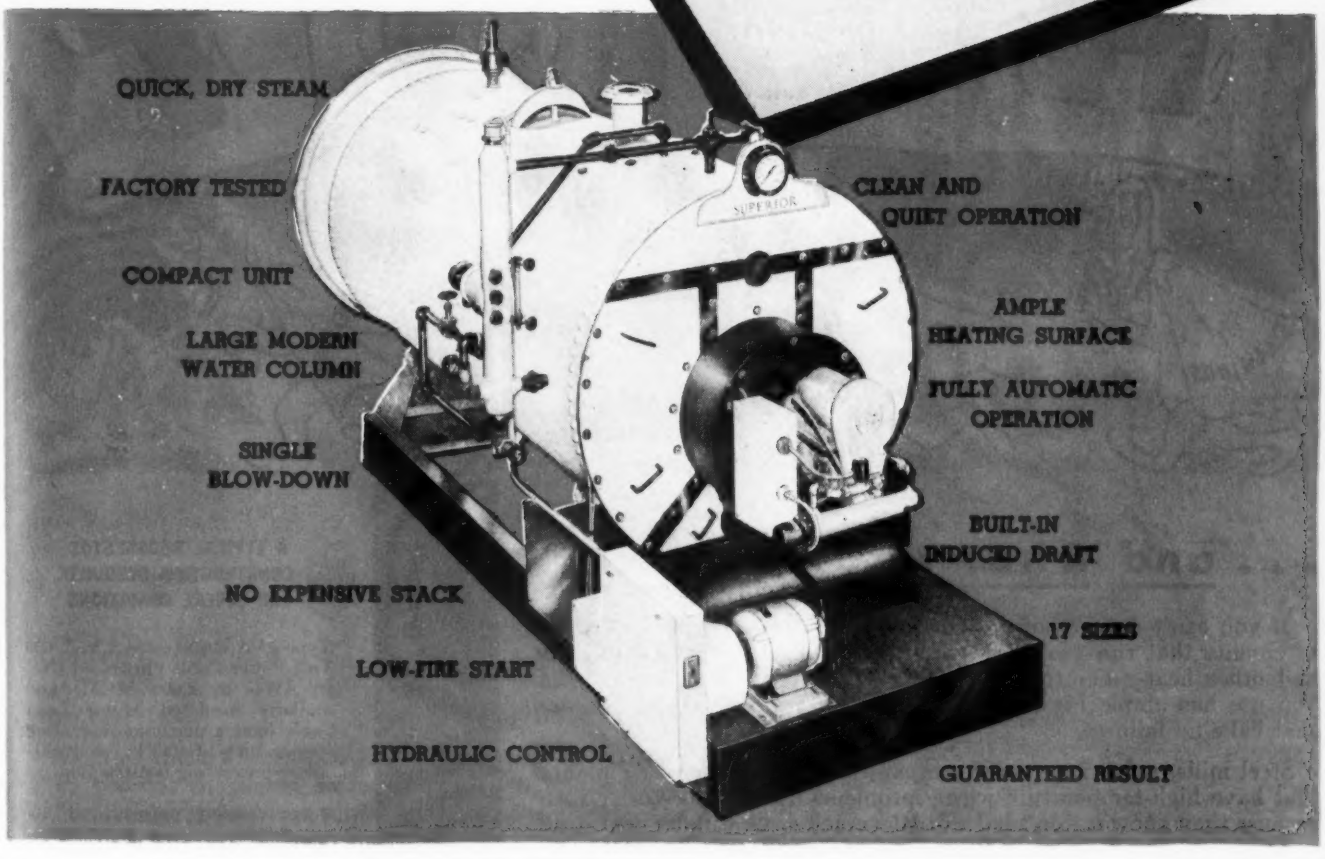
SUPERIOR *Steam Generators*



You asked for all of these features when you demanded high efficiency, simplicity and dependability in a "packaged unit steam generator". You insisted that it be capable of fully automatic operation firing all grades of fuel oil including Bunker C. You specified maximum ease of operation, minimum maintenance, smooth and quiet performance, and assurance that the rated output be easily obtained at 80% or more guaranteed thermal efficiency.

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If you can't detour hot-spots *don't guess.* Take thermal readings of circuits that run near boilers, furnaces, soaking pits, steam lines and other heat-generators. And make sure that the wire or cable you use has ample heat resistance to stand up in the *torrid zones* that bake up failures.

Steel mills, refineries, power companies and manufacturing plants that have high-temperature wiring problems use Rockbestos A.V.C. because they know it won't bake brittle, crack or flow under operating temperatures ranging as high as 230°F. They know, too, that corrosive fumes, grease or oil won't shorten its life because *impregnated asbestos* won't rot or bloom. And they also know from experience that it withstands destructive heating and cooling cycles in conduit installations where other types had to be replaced frequently.

You get these circuit-protecting advantages *plus* greater current carrying capacity in Rockbestos A.V.C.—the insulation that takes re-wiring expense out of circuit maintenance. 600 to 5,000 volt ratings include lighting and switchboard wires, lead sheathed or armored power and control cables and National Electrical Code types. Write our nearest district office for information or recommendations.

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- Age-resistant impregnated asbestos braid resists heat, flame, moisture, oil, grease and corrosive fumes.
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One of 125 different constructions designed by Rockbestos for severe or unusual operating conditions in ratings from 600 to 5000 volts.

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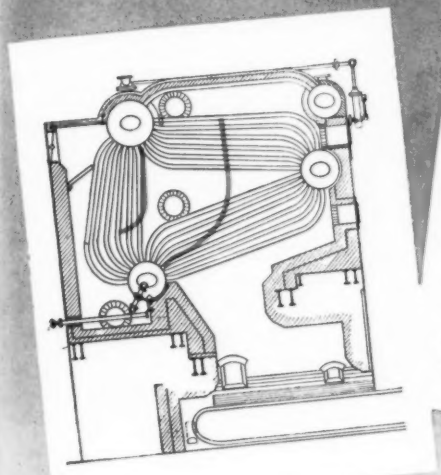
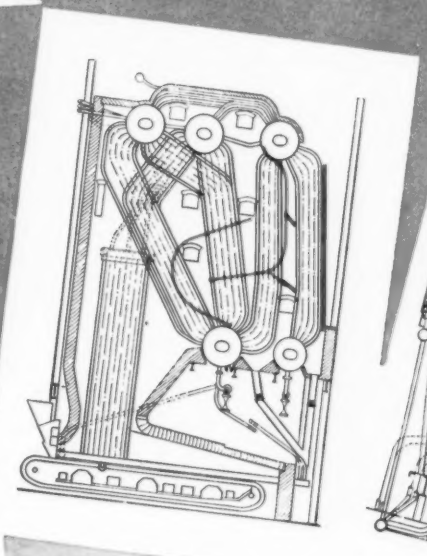
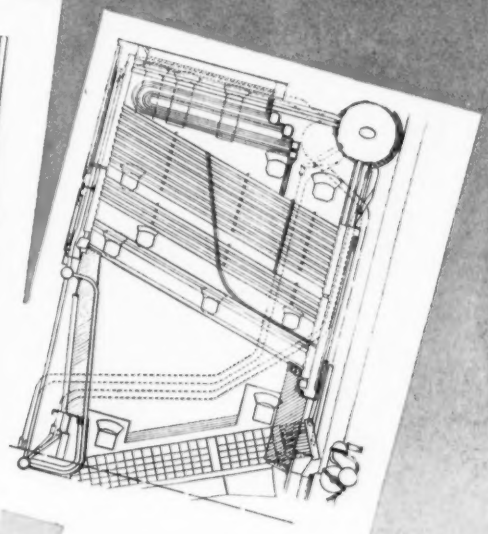
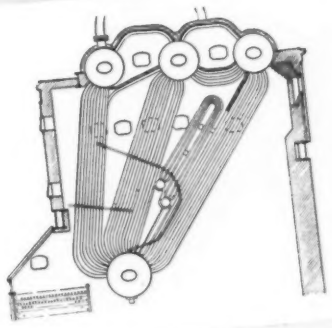
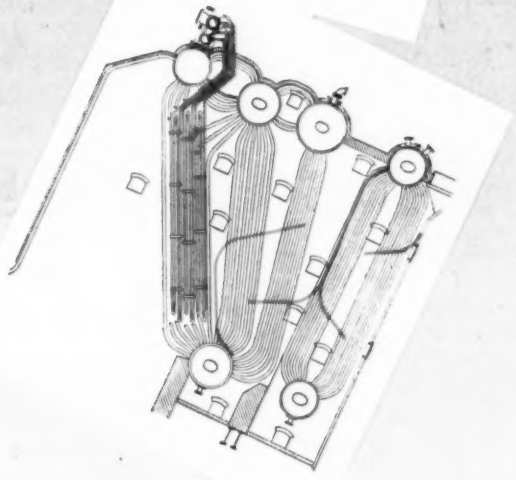
IN EVERY TYPE OF BOILER











Each of these streamlined Enco Baffles was designed to provide maximum steam output with minimum fuel consumption in a different type of water-tube boiler.

Long sweeping curves maintain a smooth cross flow of gases across every square foot of heating surface. Eddy currents, bottlenecks and dead gas pockets are eliminated—draft losses are cut to a minimum. Soot blowers work more effectively, less steam and less time are needed for cleaning.

Enco Streamline Baffles are individually designed and engineered to the exact requirements of your boiler. Experienced Enco-trained crews take charge of the installation.

The 18-page Enco Bulletin, BW44, shows how engineers throughout industry have gotten higher boiler efficiency and increased steam production through the use of Enco Streamline Baffles. Why not write for your FREE copy today?

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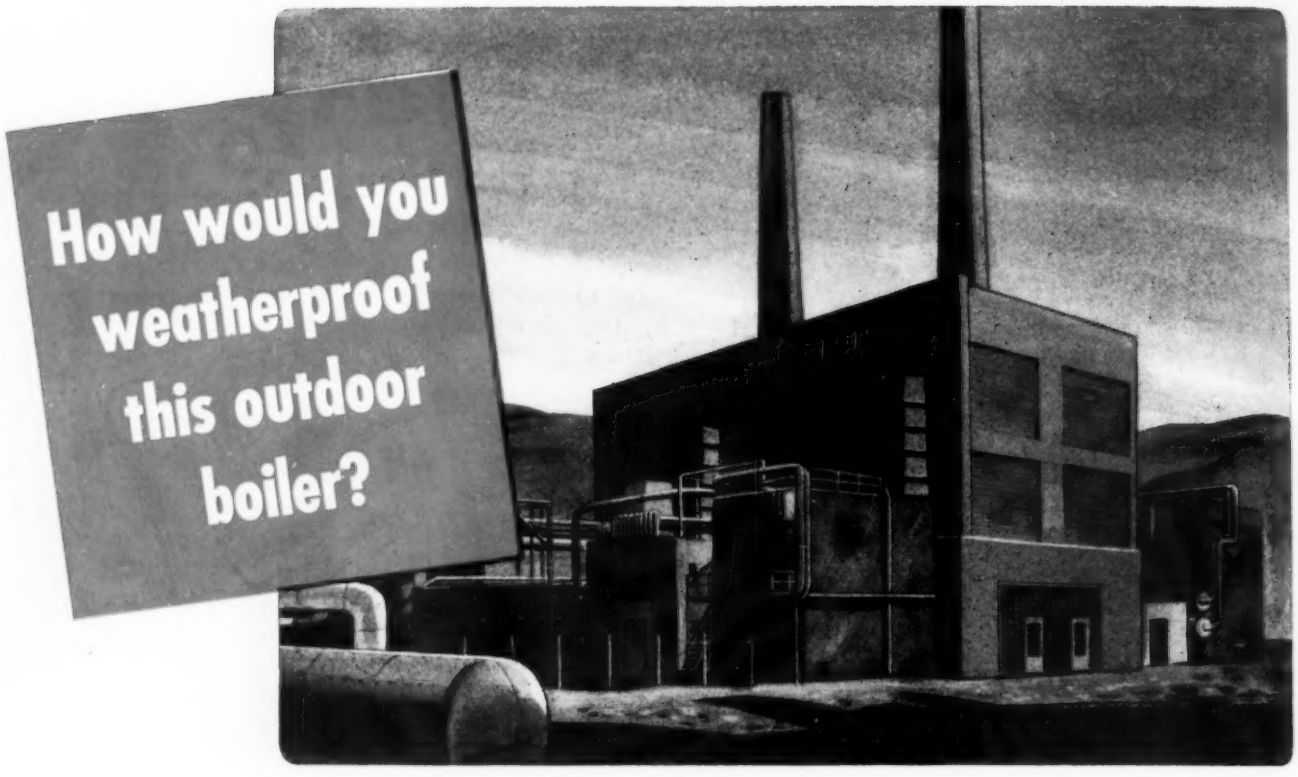


HERE'S THE PROBLEM: **A large new boiler in New England will operate outdoors. The boiler will be insulated with high-temperature block and 85% Magnesia block, ½" thicker than that specified for indoors. What's the best way to protect boiler and insulation against the weather?**

☐ **Sheet metal casing?** ☐ **Armstrong's Insulmastic?** ☐ **Plastic under and over weatherproof membrane?**

Here's what the Armstrong Engineer recommended:

Any one of these three methods will be adequate to protect against all kinds of weather. But the cost varies considerably.

If traffic is to be routed right next to the boiler, the first method, while it is most expensive, may be necessary. Certainly a casing of sheet steel is the best armor against severe bumps or abrasion.

The number 3 solution, while not particularly smooth in appearance, offers security against light impact damage at low cost.

But if the boiler is located where bumping is unlikely, the second finish will be entirely satisfactory. It is also the least expensive. Armstrong's Insulmastic is troweled on in two coats, to a total thickness of ¼". It is fireproof, flexible, won't crack or run, is smooth, neat, and takes weathering.

★ ★ ★

Today's trend is toward putting more and more processes outdoors, including power plants. The specifications, engineering, workmanship, and materials furnished by Armstrong's Contract Service make this trend entirely practical.

When you call in an Armstrong engineer to figure on any heat insulation job, indoors or out, he can offer you a considerable choice of sound materials and methods. You will find that his long experience and training, plus his insistence on exploring all the angles of the situation, will give you the most satisfactory job for your money.

FREE! NEW INSULATION CHART

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write today to Armstrong Cork Co., Industrial Insulation Department, 7011 Maple Ave., Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATION

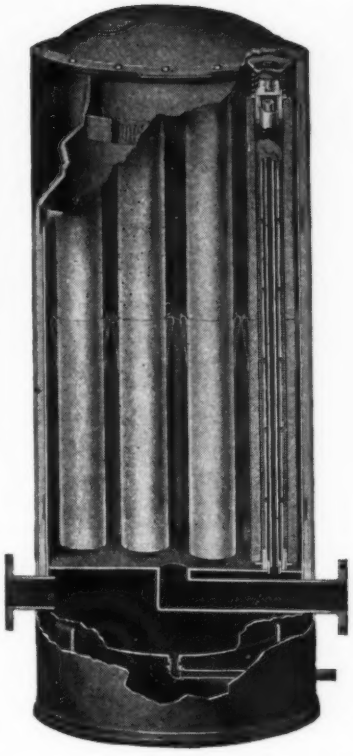
Complete Contract Service For All Temperatures

From 300° Below Zero

To 2800° Fahrenheit

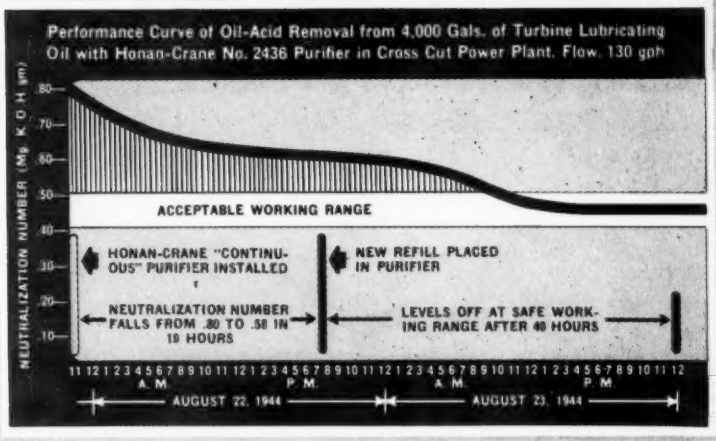
Turbine Oils Are Fully Protected by HONAN-CRANE OIL PURIFIERS

Trouble with turbine oil is rare indeed. However, when trouble does occur and the neutralization number starts rising towards the danger point, it is important to have a **Honan-Crane Oil Purifier** with fuller's earth that will reduce the organic acidity and bring the neutralization number to a safe operating level. Consider this following case history:

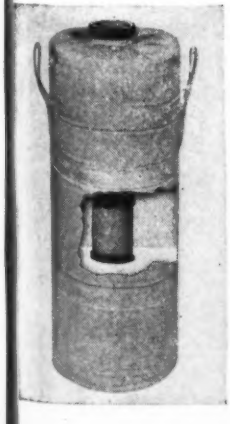


A Neutralization Number of 0.80 in 4,000 Gallons of Turbine Oil Quickly Restored to a Satisfactory Working Condition

The superintendent of a prominent power plant was confronted suddenly with a rapid increase in the neutralization number of the turbine oil in a main generating unit. With a **Honan-Crane Purifier** the neutralization number of 0.80 was reduced quickly to a satisfactory working condition. The responsibility for the sudden rise in neutralization number was found and corrected. However, a **Honan-Crane Purifier** insured safe operation until difficulties were corrected.

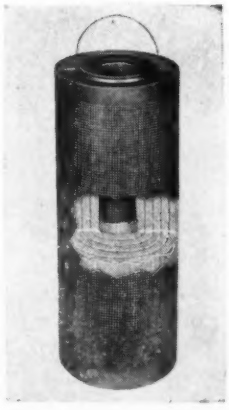

Performance Curve of Oil-Acid Removal from 4,000 Gals. of Turbine Lubricating Oil with Honan-Crane No. 2436 Purifier in Cross Cut Power Plant. Flow. 130 gph
NEUTRALIZATION NUMBER (Mg. K O H gm)
.80
.70
.60
.50
.40
.30
.20
.10
ACCEPTABLE WORKING RANGE
HONAN-CRANE "CONTINUOUS" PURIFIER INSTALLED
NEW REFILL PLACED IN PURIFIER
NEUTRALIZATION NUMBER FALLS FROM .80 TO .58 IN 19 HOURS
LEVELS OFF AT SAFE WORKING RANGE AFTER 40 HOURS
11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
A. M.
P. M.
A. M.
P. M.
AUGUST 22, 1944
AUGUST 23, 1944

Type "M" Honan-Crane Purifiers are Designed to Use Either Fuller's Earth or Honan-Crane Fibrous Filtering Medium



"MC" CARTRIDGE FOR "M" TYPE PURIFIERS

Contains 15 lbs. Cranite (specially processed fuller's earth). Recommended where a complete job of purification is desired. Will remove solids, abrasives, acids, sludges and all other types of contamination.



"MF" CARTRIDGE FOR "M" TYPE PURIFIERS

Contains a balanced mixture of cellulose fibers of high filtering efficiency. Recommended for oils where large solids alone, such as abrasives, scale, etc., are the objectionable contaminants to be removed.

When starting a new turbine employing rust inhibited type turbine oils, the **Honan Crane** fibrous filter cartridges can be used to remove cuttings, foundry sand and other larger size objectionable abrasives.

When the rust inhibitor has had sufficient time to plate out and protect the surfaces of the oiling system against corrosion, a purifier cartridge employing fuller's earth as a purifying medium can be used when it is necessary to restore the oil to its original physical and chemical properties of neutralization number and S. E. values.

The useful life of turbine oils can be indefinite when a **Honan-Crane Purifier** is available to be used when necessary.

CUT OUT AND MAIL THIS COUPON NOW

HONAN-CRANE CORPORATION
1200 SIXTH STREET, LEBANON, INDIANA

☐ Please send complete information on HONAN-CRANE Purification of Turbine Oils.

☐ Please have Sales Engineer call.

NAME..... TITLE.....

COMPANY.....

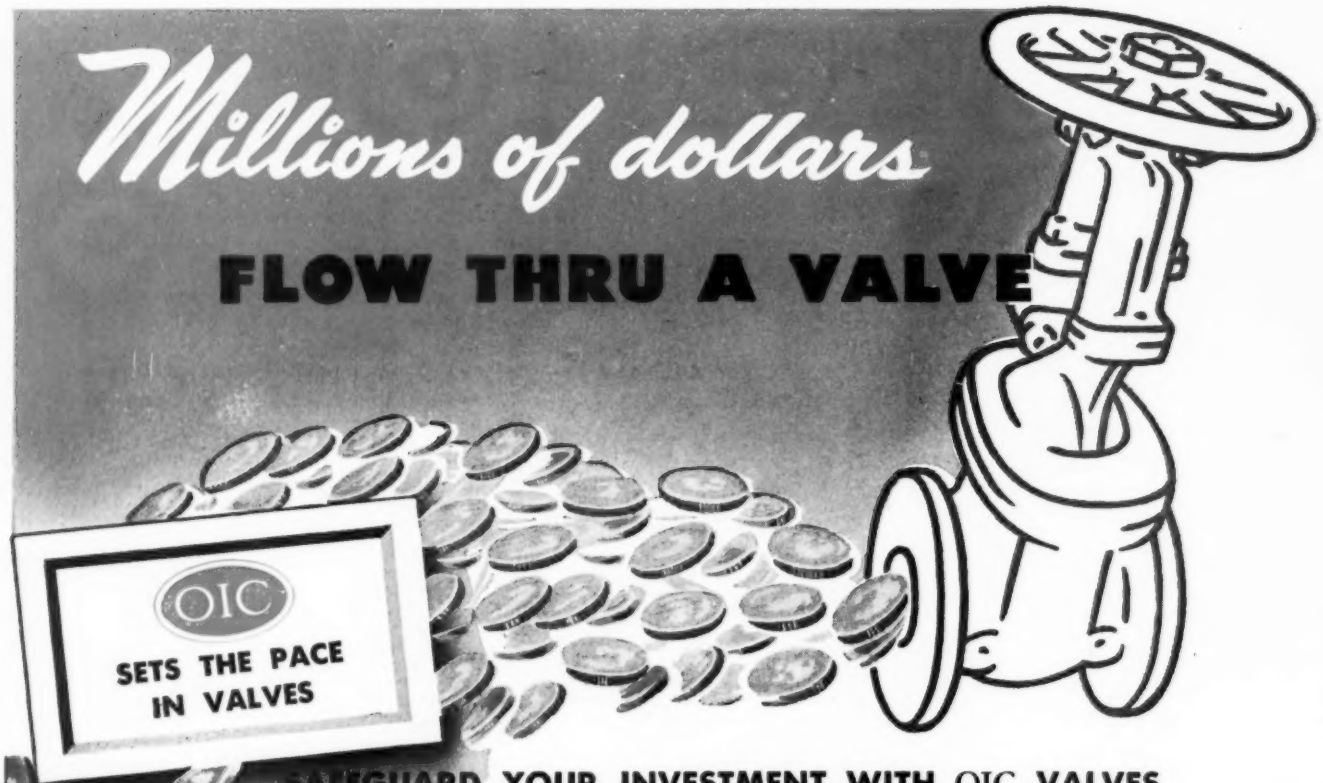
STREET..... ZONE.....

CITY..... STATE.....

A SUBSIDIARY OF **HOUDAILLE-HERSHEY CORP.**

Millions of dollars

FLOW THRU A VALVE

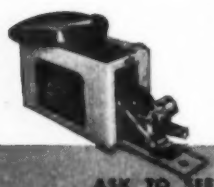


SAFEGUARD YOUR INVESTMENT WITH OIC VALVES

TO CONTROL the flow of steam, water, oil or gas that keep your industry running, play safe with OIC valves. Your engineer will verify that OIC provides the last word in design . . . often goes *beyond* the regular strength and quality specifications. Purchasing agents find that advanced production methods in the "model" OIC plant provide a lot of valve for the money. Maintenance men approve of exclusive OIC features such as the *patented* gland and gland flange that provides unobstructed access to the stuffing box . . . extra-long bushings that reduce thread wear . . . the special condensation chamber that protects *all* the packing in high-temperature steel valve service. It *pays* to invest in the best in valves, the pace-setter is OIC!

PRECISION-SLOTTING IN OIC VALVES PREVENTS LOOSE PARTS

OIC gate valves live a long, useful life because they're not worn out by continual scraping of wedge faces . . . everlasting "chatter." All OIC gate valve wedges are "precision-slotted." Accurate guides in the body provide an exact track for the slot to slide on as the wedge raises and lowers. This prevents extra wear on the smooth-finished wedge face. It also assures efficient operation when the valve is installed sideways. It's another OIC "plus" . . . another reason why OIC *continues* to Set The Pace In Valves!



ASK TO SEE THE OIC FILMS!

Valve buyers everywhere are enthusiastic about the information-packed OIC sound slidefilms. Showings are booked ahead, so mail your reservation today! Address inquiries to *The Ohio Injector Company*, Wadsworth, Ohio. OIC will do the rest!

OIC

VALVES

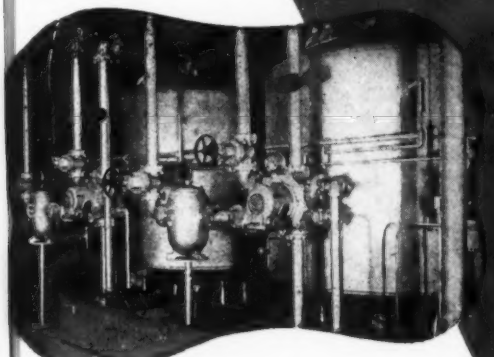
STEEL • IRON • BRONZE

No boiler scaling or corrosion with Permutit-conditioned water

It's a big load off the minds of management, too—once a plant is equipped with Permutit® Water Conditioning. Heavy power loads can seriously damage equipment and even tie up production. For, as any operating engineer knows, the danger of boiler scale and corrosion or steaming due to impurities in feedwater increases with the load.

Permutit removes the threat to output by removing the impurities in feedwater *before it enters the boiler*. Water conditioning headquarters for the power industry, Permutit provides the processes for control of water quality.

Don't let untreated water constantly threaten the operating efficiency of your plant. Take a load off your mind . . . bring that water treatment problem to The Permutit Company, Department, 330 West 42nd Street, New York 18, N. Y., or Permutit Co. of Canada, Ltd., Montreal.



PERMUTIT ZEO-KARB® H WATER CONDITIONER removes both hardness and bicarbonates from water. Effluent contains no incrustants, is reduced in total solids and alkalinity. Alkalinity can be adjusted by mixing effluents from a Zeo-Karb H unit and a sodium zeolite unit.

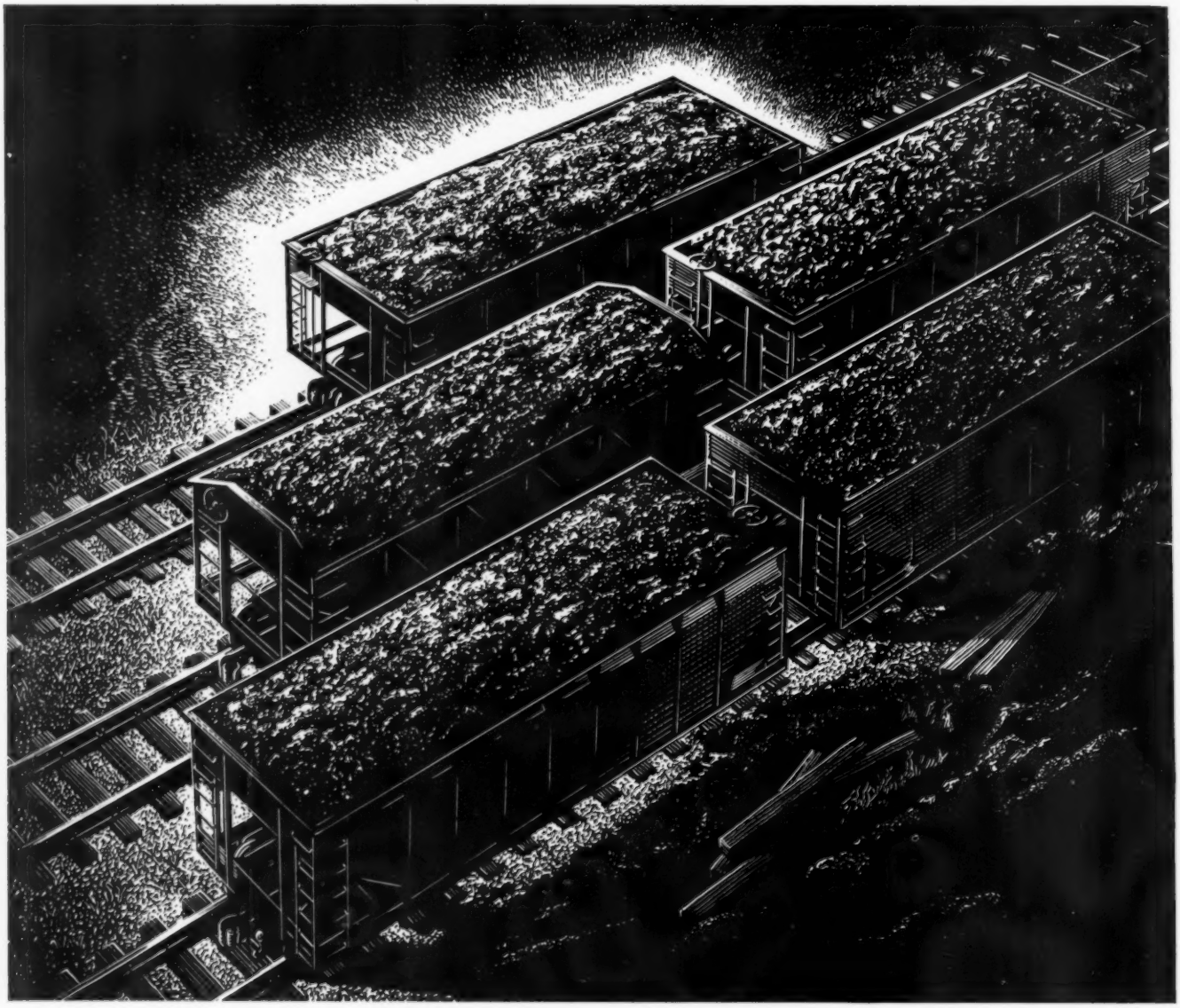
*Trademark Reg. U.S. Pat. Off.

PERMUTIT

Manufacturers of ALL types of water treatment equipment

WATER CONDITIONING HEADQUARTERS

"It's good business to begin with Good Water"



What do you pay for parking?

Plenty! Just count up the number of days railroad cars stand on your siding waiting to be unloaded.

Then figure out your overtime car rental fees—your demurrage charges. Sizeable sum, isn't it?

Maybe you look on this parking expense as necessary overhead. That used to be true. But it isn't any more!

Today there's a new way to empty hopper cars. It's fast, efficient and economical. It helps you wipe out those "fines" for overtime parking.

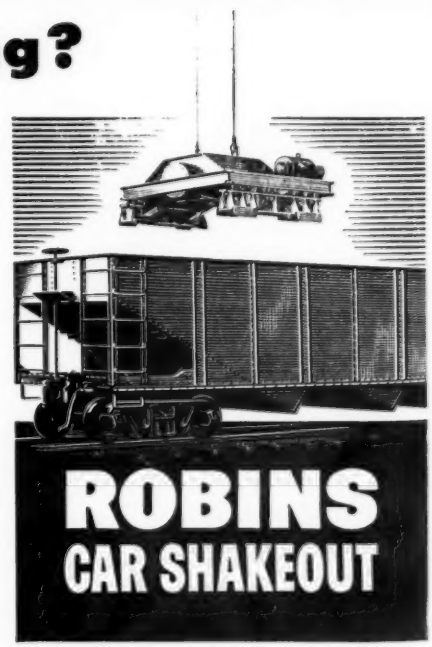
It's the new Robins Car Shakeout! It *shakes* the material in the car loose . . . enables it to flow freely and quickly through the hopper doors. It empties 50- or 70-ton cars "broom-clean" in as little as 90 seconds. It unloads them no matter how tightly the load is packed. It even empties loads that are frozen solid!

Actual field operations by hundreds of users prove that this new method of unloading hopper cars is as much as twelve times faster than manual unloading.

The Robins Car Shakeout performs its operation with no damage to the car . . . with no danger to the operator. It saves you hours of labor and much time and money.

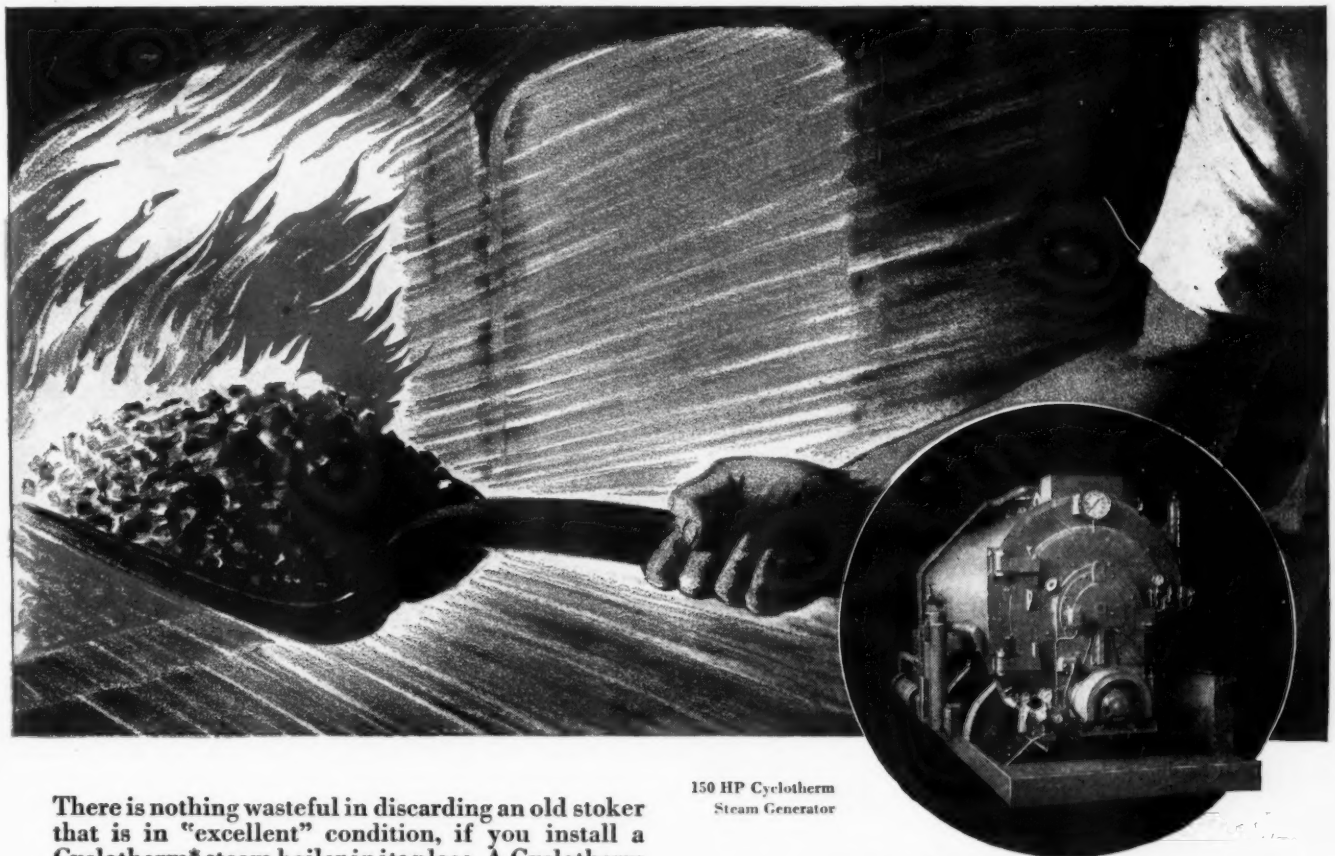
Why not find out how a Robins Car Shakeout will help you eliminate overtime parking fines?

A note on your company letterhead to Dept. N-3, Robins Conveyors Division, Passaic, N. J., will bring you this new booklet about the Robins Car Shakeout. Or ask for a Robins engineer to tell you the complete story in person. No obligation!



ROBINS CONVEYORS DIVISION, Hewitt-Robins Incorporated, Passaic, N. J.

There's a better way to manufacture steam



150 HP Cyclotherm Steam Generator

There is nothing wasteful in discarding an old stoker that is in "excellent" condition, if you install a Cyclotherm* steam boiler in its place. A Cyclotherm soon pays for itself in savings in fuel, labor and replacement of parts.

These savings are made possible through the Cyclotherm patents which control a combustion principle that burns fuel *completely* in the first pass of a two-pass boiler. The fuel is first atomized and then burned in a rapidly revolving highly radiant cyclone of flame which advances slowly through the length of the furnace tube so that heat is radiated intensely and uniformly.

Cyclotherm units operate at 80% efficiency. Conductive to this efficiency, Cyclotherm steam boilers of 80 to 300 HP are equipped with an automatic modulating steam pressure control system which regulates the volume of the flame in response to steam requirements. Firing rates are modulated from 30% to 100% of rated capacity. Units of 10 to 60 HP operate "on-and-off", immediately responsive to thermostat or pressure control, a method equally economical on small boilers.

Cyclotherm will burn gas (natural and manufactured) or oil (from furnace to bunker). Combination units are also available which can be fired with either oil or gas.

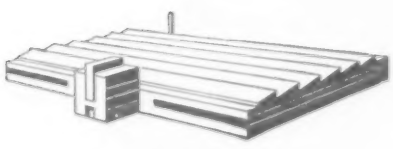
Cyclotherm boilers are manufactured in a range of sizes from 10 to 300 HP with operating pressures from 15 to 200 psi. The steam output range is from 345 lbs. per hour, (with feed water at 212° F) to 10,390 lbs. per hour. If your steam requirements are greater, a battery of two or more Cyclotherms is recommended. Batteries up to eight Cyclotherms are now giving highly satisfactory service.

Cyclotherm is delivered to your door as a complete, packaged unit. All that is necessary to put it to work are four connections — electricity, water, fuel and steam.

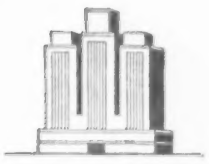
Cyclotherm can now assure you prompt factory delivery.

For further information write for our specially prepared booklet **502Z.**

POWER



PROCESSING

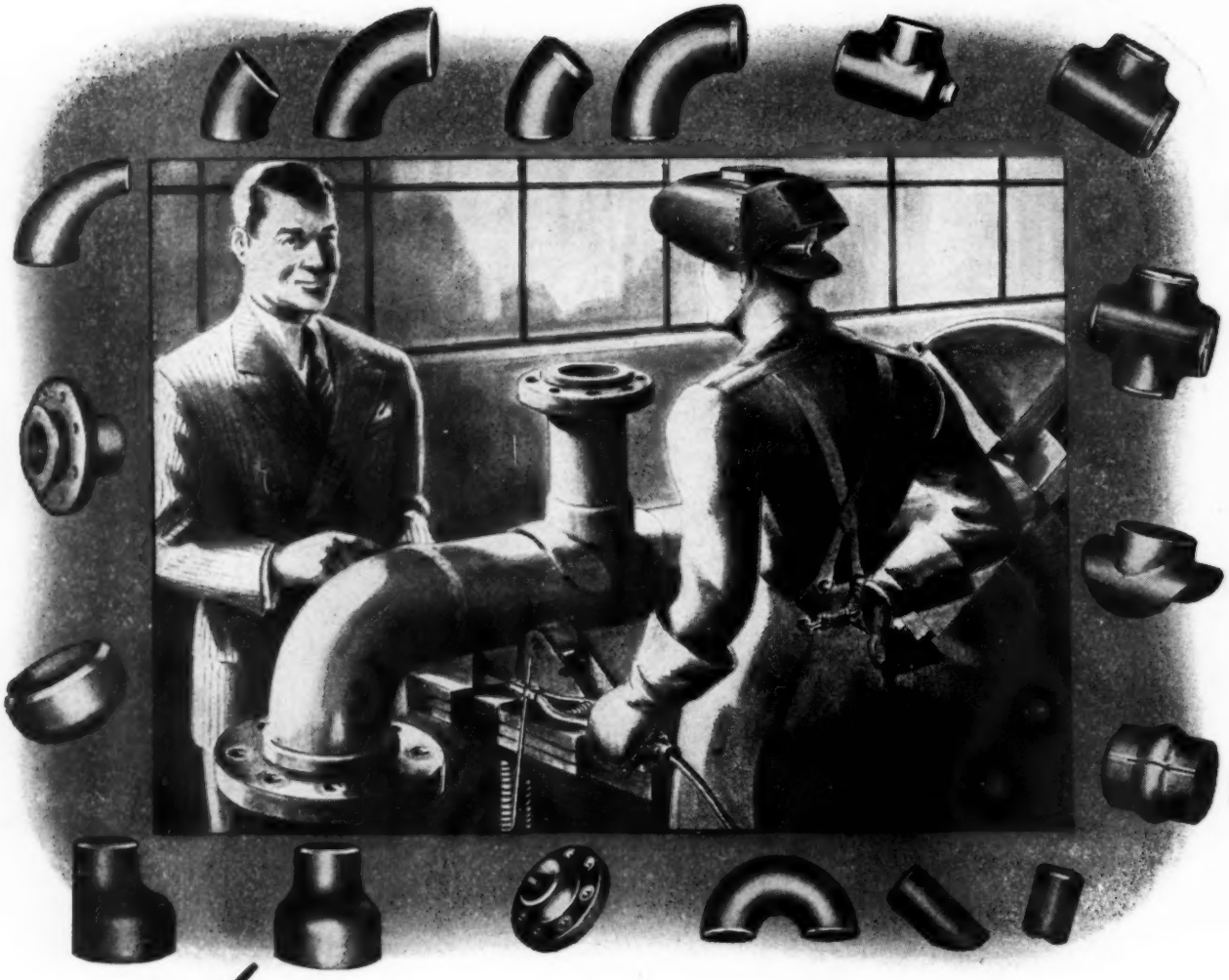


HEATING

CYCLOTHERM STEAM GENERATORS

CYCLOTHERM CORPORATION, 90 BROAD STREET, NEW YORK 4, N. Y.

*"Cyclotherm"—the registered trade mark of products of Cyclotherm Corporation



Ask **THE WELDER OF PRESSURE PIPING**

what he thinks of

MIDWEST WELDING FITTINGS

You will find that he gives them hearty approval. Piping welders generally have a high appreciation of the exceptional dimensional accuracy and uniformity of Midwest Welding Fittings . . . their job is easier and they can turn out better work faster.

Midwest Welding Fittings have extraordinary dimensional accuracy because particular precautions are taken in their manufacture. Midwest Welding Elbows, for example, are made slightly oversized, then reheated to forging temperature and given a final accurate sizing in compression. This provides accurate dimensions, true circular section, and uniform wall thickness. Comparative corrosion tests as well as tensile and ductility tests have proved the beneficial effect of forging the metal in compression.

Welders also appreciate the wide variety of Midwest Welding Fittings . . . including "Long Tangent" elbows and reducing elbows. There is a fitting for practically every condition he encounters. Ask the local distributor or our nearest office for Bulletin WF-41.

MIDWEST

PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Sales Offices: New York 7—30 Church St. • Chicago 3—79 W. Monroe St. • Los Angeles 33—520 Anderson St. • Houston 2—229 Main Bldg. • Tulsa 3—833 Main Bldg. • South Boston 27—426 First St. • Distributors in Many Cities

TAPER-LOCK BRAND

THE NEW TIME-SAVING TAPER BORE SHEAVE

TAPER-LOCK has the simplest, surest mechanism ever devised for holding wheels to shafts...TAPER-LOCK saves time. You slip it on the shaft, line it up and tighten while sighting...TAPER-LOCK runs true. It holds with a firmness equivalent to a shrunk-on fit, yet it disengages with less effort than any other sheave.

TAPER-LOCK sheaves are available in all the most wanted sizes. Thus Dodge has not only created a great new product in the power transmission field, but has made this product adaptable to needs throughout industry.

TAPER-LOCK is a striking example of the new Dodge products which help you put more power on the job — cut costs and increase production. The savings which Dodge equipment make possible will be important to you in the competitive days ahead. Get the full story — now.

DODGE MANUFACTURING CORPORATION
MISHAWAKA • INDIANA

IN ALL THESE STOCK SIZES:

CLASS SHEAVE	PITCH DIAMETER	NUMBER GROOVES	TOTAL SIZES
DUAL DUTY "A"	3.0 to 18.0	1 to 6	150
DUAL DUTY "B"	4.6 to 18.4	1 to 6	114
B	5.4 to 38.0 20.0 to 38.0	7 to 10 2 to 10	76 36
C	9.0 to 44.0	3 to 10	128
D	13.0 to 33.0	4 to 10	77

DODGE

of Mishawaka, Ind.

CALL THE TRANSMISSIONEER

He's a factory-trained specialist qualified to analyze your mechanical power transmission needs and recommend correct equipment. Consult him without obligation. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

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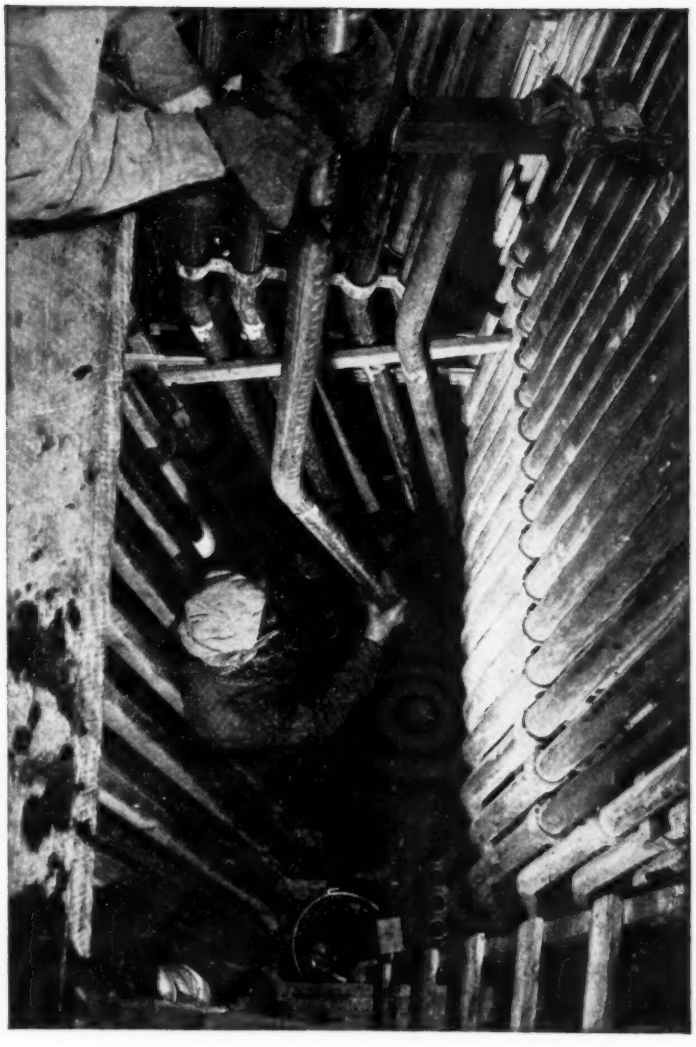
NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

TUBES

for ALL Power Plant Purposes from this ONE *Dependable Source*



B&W is the one place you can get Seamless or Welded steel tubes for any requirement in your power plant. Boiler, condenser, heat-exchanger and other pressure tubes are made by B&W in the widest variety of analyses available from a single source—from low carbons to high alloys, including a full range of stainless steels of the ferritic and austenitic groups; carbon-molybdenum steels, and Croloy grades developed by B&W.

In many cases, your orders for B&W Tubes can be promptly filled from local warehouse stocks by authorized distributors located in all principal cities.

TA-1405C

B&W

Other B&W Products

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Water-Tube Boilers, for Stationary Power Plants, for Marine Service • Water-Cooled Furnaces • Superheaters • Economizers • Air Heaters • Pulverized-Coal Equipment • Chain-Grate Stokers • Oil, Gas and Multi-fuel Burners • Refractories • Process Equipment.

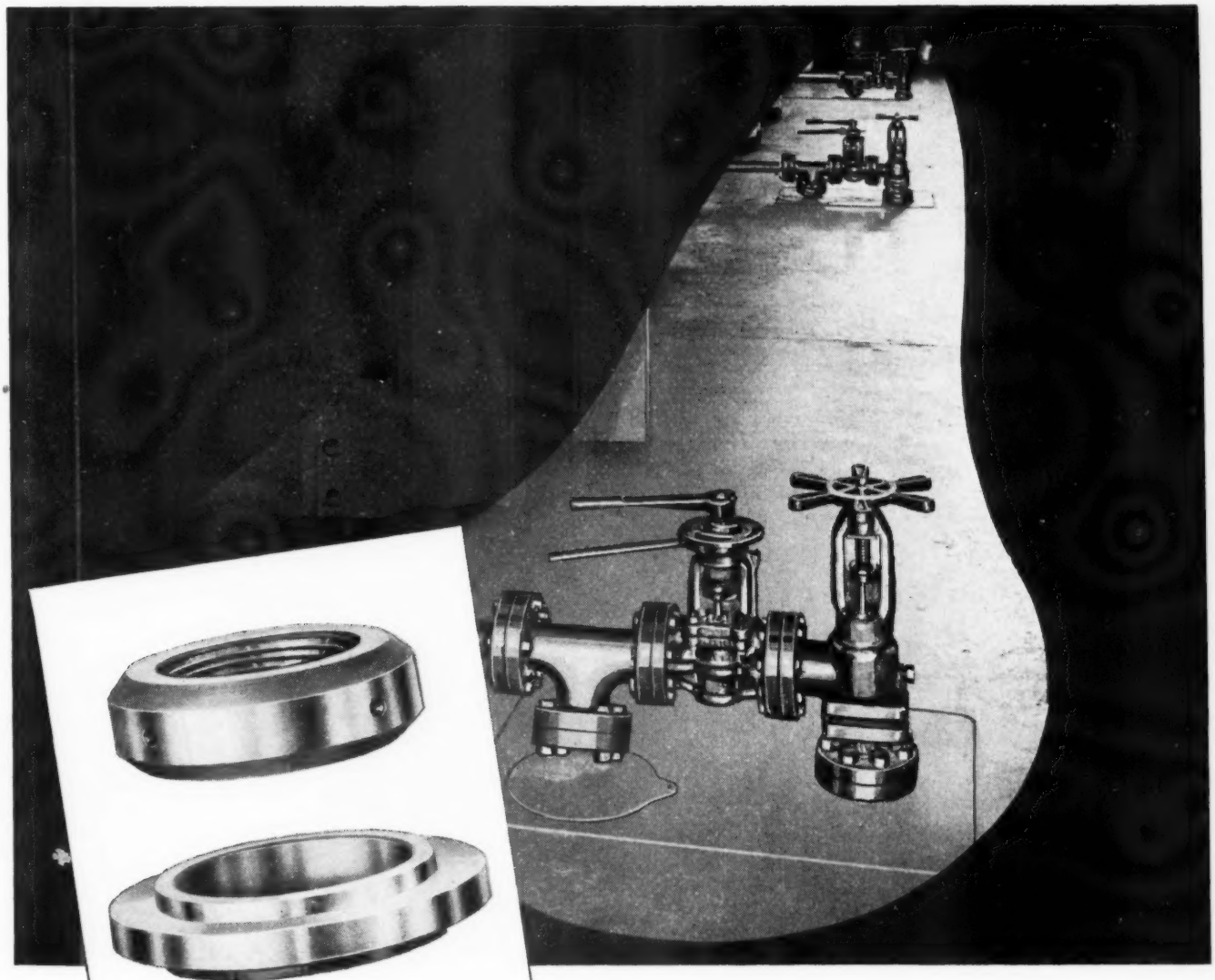
BABCOCK & WILCOX

SEAMLESS & WELDED TUBES

THE BABCOCK & WILCOX TUBE COMPANY

GENERAL OFFICES: BEAVER FALLS, PA.

PLANTS: ALLIANCE, OHIO AND BEAVER FALLS, PA.



This

REVERSIBLE SEAT

means

DOUBLE VALVE LIFE

and 30% to 60% LESS MAINTENANCE EXPENSE

HOVALCO HOMESTEAD COMBINATION BLOW-OFF VALVES are built to outlast the boiler. Records of 25 to 30 years continuous use in boiler blow-off service are not uncommon. And not only do they have double the life span of ordinary valves, but they cost 30% to 60% less to maintain.

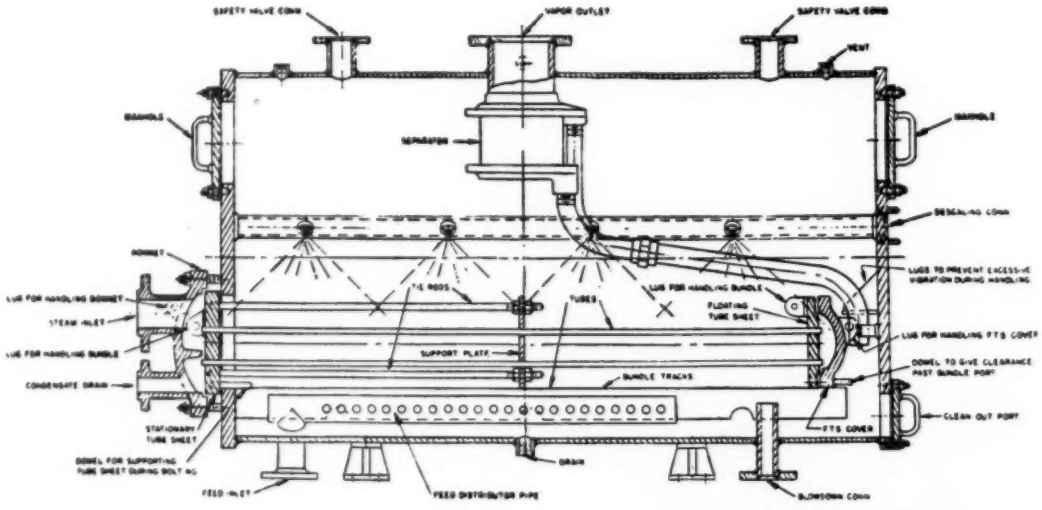
The HOVALCO ANGLE VALVE which takes all of the abuse and regulates the flow, is equipped with a special *reversible,* long wearing, "S" Monel seat and disc which is actually an "extra" set of accurately ground, perfectly matched seating surfaces ready to be put into service whenever the need arises. By simply unbolting the lower valve body and turning over the seat and disc, you have a good-as-new valve ready for another long lifetime of service.

Used in combination with HOMESTEAD LEVER-SEALD or CAM-SEALD QUARTER-TURN VALVES, they meet A.S.M.E. requirements and all state laws for boiler blow-off service.

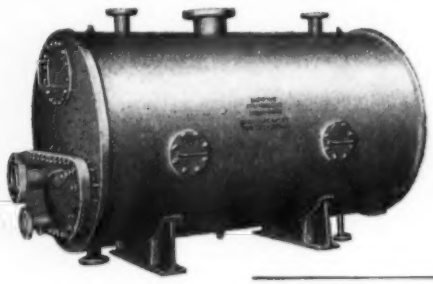
We can furnish them in sizes 1½", 2" and 2½" for pressures to 600 pounds. Further detailed information and Valve Reference Book No. 38 will be mailed on request.

HOMESTEAD VALVE MANUFACTURING COMPANY

P. O. Box 210 **Coraopolis, Pa.**



Sectional elevation of a
Lummus Power Plant Evaporator



adequately designed—

for operation and maintenance

Pure water from any raw or salt water supply

Lummus experience . . . in designing and fabricating power plant evaporators to meet individual requirements . . . is your guarantee of a dependable supply of pure water from any raw or salt water source.

Full-efficiency operation is assured by a soundly based design that provides adequate vapor separators and liberal, properly balanced disengaging areas. Easy maintenance is assured by a practical understanding of field conditions. All connections are readily accessible and do not require disassembly within the unit to remove the tube bundle.

Lummus engineering service is always available for the study of specific heat exchanger problems and equipment design to meet individual power plant conditions. May we give you further information?

THE LUMMUS COMPANY
420 Lexington Avenue, New York 17, N.Y.

LUMMUS

Atlanta • Boston • Chicago • Cleveland • Corpus Christi
Detroit • Houston • Fort Worth • Philadelphia • Pittsburgh
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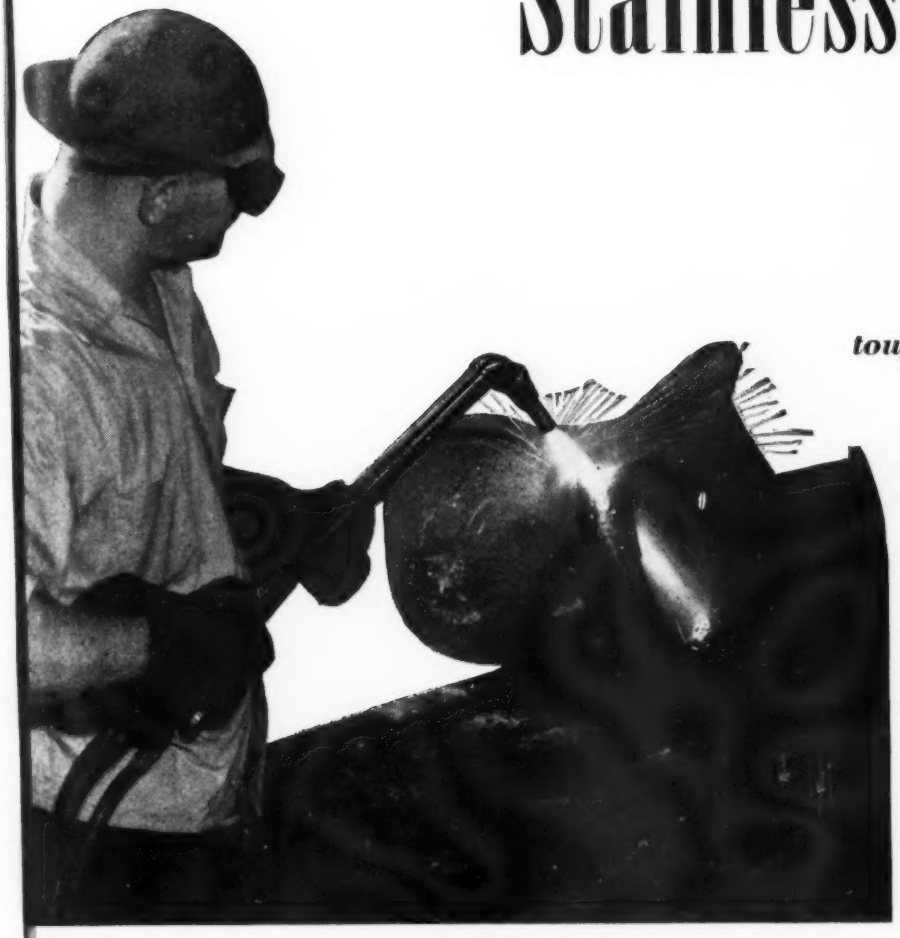
LOOK TO LUMMUS FOR: Heat Exchangers • Process Condensers • Reboilers • Steam Generators • Steam Jet Refrigeration Steam Surface Condensers • Barometric Condensers • Steam Jet Air Ejectors • Evaporators • Boiler Blowdown Heat Exchangers Fuel Oil Heaters • Lubricating Oil Coolers • Pipe Line Coolers • Feed Water Heaters • Jacket Water Coolers

Stainless Steel is TOUGH



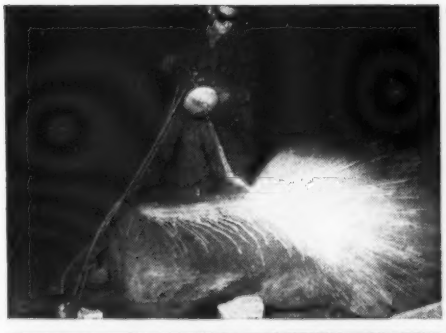
tough to cut, too—but LINDE makes the job easier . . . just as easy as cutting carbon steel

LINDE's powder-cutting process overcomes the barrier to fast and economical cutting of stainless or chromium steels.

By means of easily installed attachments for standard oxy-acetylene equipment, powder-cutting can be done without substantial change from carbon steel cutting techniques.

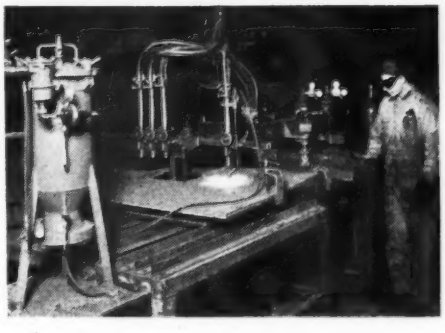
IN FOUNDRIES—

by powder-cutting, risers are removed 20 times faster than by older methods. Removal of riser pads and gouging out defects can be done at considerable savings in cost.



IN STEEL MILLS—

a 12,000-lb. ingot can be powder-scarfed in 4 to 6 hours—about 1/10 the time required for grinding. Sizing of ingots, billets, and slabs, removal of hot tops, scrapping operations, and many other cutting jobs can be done in a fraction of the time previously required.



IN FABRICATING PLANTS—

a stack of twelve 10-ga., type-304 stainless sheets were powder-cut at 8 in. per min. . . . 4-in. I.D. by 8-in. O.D. flanges on ½ in., type 316 plates were made in 2 minutes of cutting time apiece.

If you work with stainless steel you will want to know more about this LINDE process. LINDE can supply the equipment you need, help you to set up, and supply the training help you need.

Linde

The word "Linde" is a registered trade-mark of The Linde Air Products Company.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 East 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities

In Canada: DOMINION OXYGEN COMPANY, LIMITED, Toronto

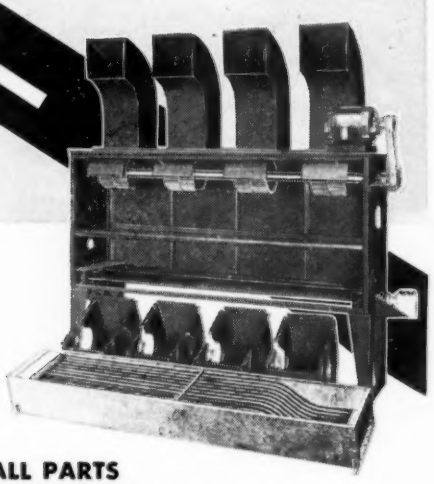
FUEL COSTS GO DOWN—

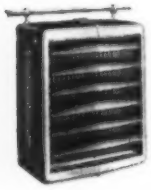
When You Install UNITHERMS!

Another winter coming up — and present fuel prices the highest in history!

Clarage Unit Heaters *MORE* than pay their own way — not only by reducing fuel costs substantially, but by helping you maintain top-level production so dependent upon uniform, comfortable temperatures.

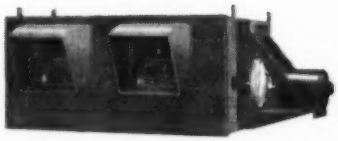
We build units to meet all types of heating jobs, operating on either steam or hot water. *Consult with our application engineering office in your city, or write us at Kalamazoo.*





. . . for Smaller Jobs and to Help Out

Clarco horizontal and vertical units are used for heating small factory areas, buildings where heat losses are concentrated around outside walls, for offices, etc. They take no floor space — suspend them from walls or ceiling.



Suspended Type Saves Floor Space

These Unitherm Unit Heaters can be easily attached to roof members, or suspended at other convenient locations. All Unitherms deliver heat at high velocity over wide areas — equipped with centrifugal fans; heating coils for pressures up to 200 lbs.; V-belt drive or direct connected.

ALL PARTS EASY TO GET AT . . . . . .

View above shows Floor Type Unitherm Unit Heater with fan housings and heating coil removed. All parts are accessible by loosening a few bolts and taking off front or back side of heater casing.

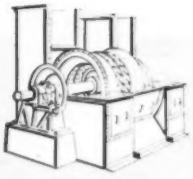
Clarage

—HEADQUARTERS FOR AIR HANDLING AND CONDITIONING EQUIPMENT

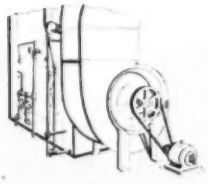
CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

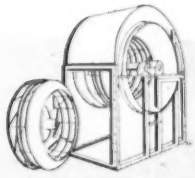
AIR WASHERS AND PURIFIERS



MECHANICAL DRAFT

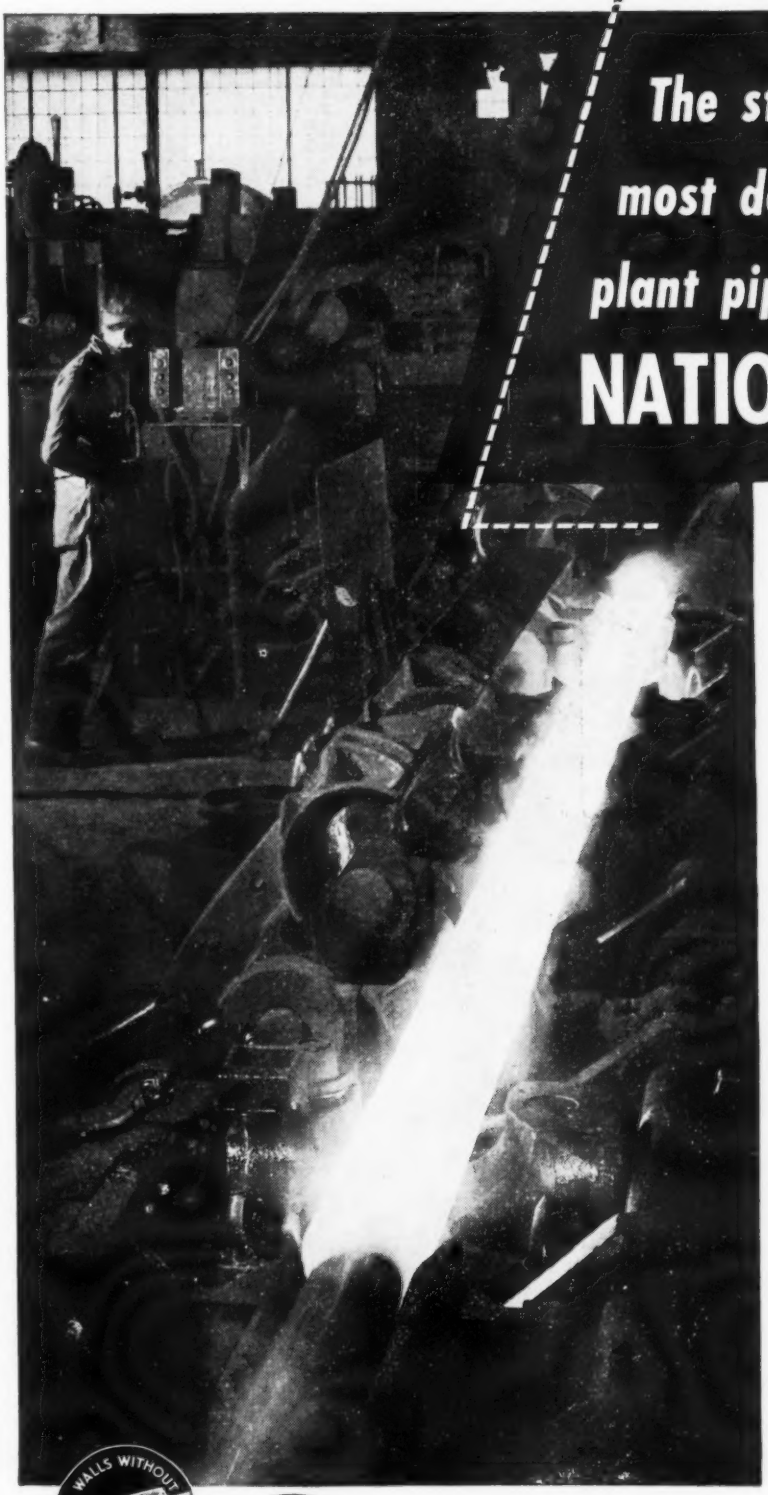


INDUSTRIAL AIR CONDITIONING



AIR FOR INDUSTRIAL PROCESSES

...HERE'S WHERE IT STARTS!



The strongest, most uniform, most dependable power plant piping — NATIONAL SEAMLESS

Piercing a solid billet of steel to form a seamless tube!

No other process of tubemaking so drastically tests the *quality* of the steel. Only the soundest, most uniform material could withstand such rigorous treatment without disclosing even minor defects.

It is the only process that absolutely removes all uncertainty regarding uniform wall strength. For no method of joining metals yet devised, can provide, with invariable certainty, the structural homogeneity and the assured safety, security, and dependability of a solid forging. And a NATIONAL Seamless pipe or tube is exactly that—one continuous piece of steel without weld of any kind, structurally sound from end to end.

That is why in many cases involving severe or hazardous service, the use of *seamless* pipe is mandatory. That is why NATIONAL Seamless Pipe—the famous "Walls without Welds" —has never been surpassed for power plant service.

And remember this. The uniform wall strength of NATIONAL Seamless Pipe has a direct and beneficial relation to bending, expanding, flanging, beading and all other working of the pipe. NATIONAL Seamless thus not only stands for the *safest* pipe ever developed for critical power plant service, but for the easiest pipe to work with.

WALLS WITHOUT WELDS

NATIONAL TUBE COMPANY · USS STEEL · UNITED STATES STEEL

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

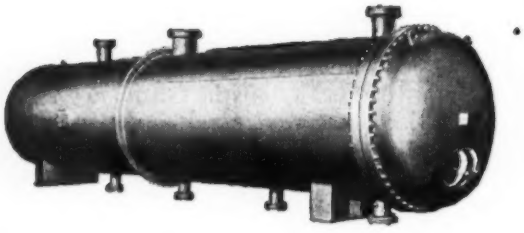
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

UNITED STATES STEEL

HOW G-R has led in EVAPORATOR DESIGN and APPLICATION

1st. ..... G-R DEVELOPED

- THE FIRST *marine evaporator*
- THE FIRST *stationary evaporator*
- THE FIRST *"multiple-effect" system*
- THE FIRST *"associated" system*
- THE FIRST *"scale-shedding" elements*
- THE FIRST *"reducing valve" system*
- THE FIRST *"waste heat" evaporator*

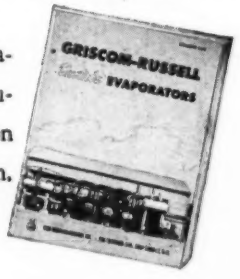


The many G-R "firsts" in the development of evaporators for producing pure boiler feed make-up indicate the leadership which has resulted in installations serving a total of more than 40,000,000 boiler horsepower.

The different types of evaporator systems which have been originated by G-R provide an efficient arrangement for a wide variety of requirements . . . for example; "associated" systems for maximum heat economy in high-duty plants, "reducing-valve" systems for economical generation of process steam in industrial plants, "waste heat" evaporators for recovering the heat from hot process fluids in petroleum refineries and chemical plants.

In addition, the many distinctive features of G-R Bentube Evaporators . . . their scale-shedding elements, provisions for pure dry vapor, dependable operation, and convenience of access to all parts . . . assure economy of attendance and maintenance as well as thorough elimination of all raw-water impurities.

Investigate G-R Bentube Evaporators . . . write for Bulletin 364 and authoritative advice, without obligation, on your boiler feed purification problem.



THE GRISCOM-RUSSELL CO.

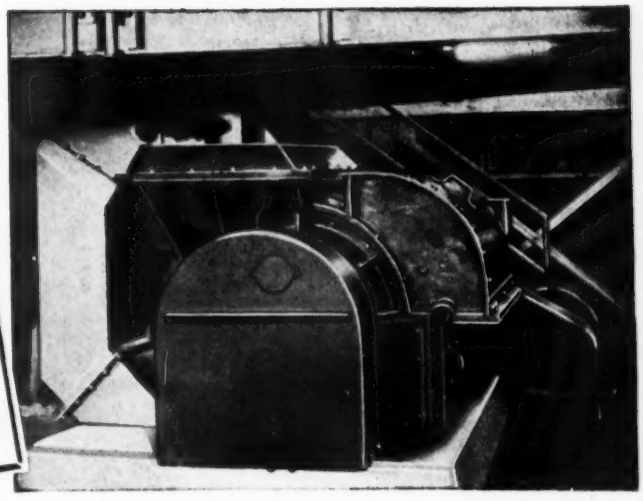
285 Madison Avenue • New York 17, N. Y.

GR-185

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

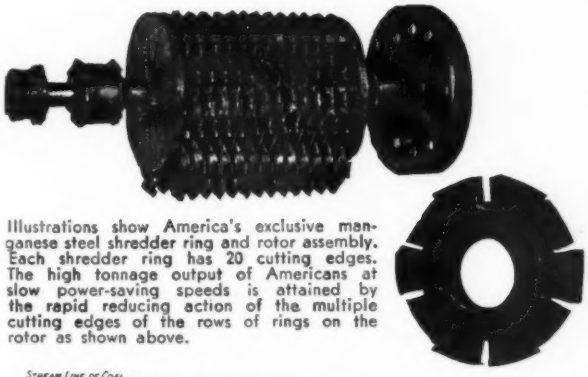
for a low cost coal crushing operation that's COMPACT AND COMPLETE



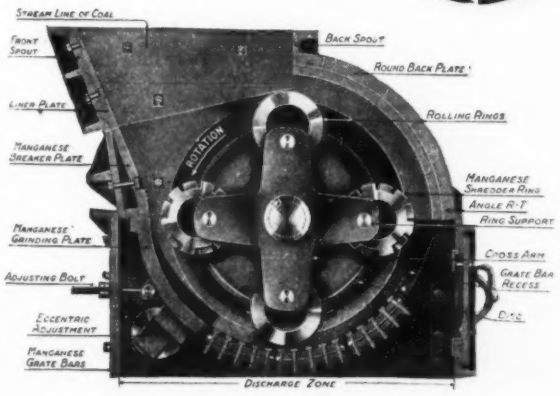
AMERICAN ROLLING RING CRUSHERS

—installed in minimum headroom as a complete high capacity coal preparation plant

COAL IS SPLIT NOT CRUSHED



Illustrations show America's exclusive manganese steel shredder ring and rotor assembly. Each shredder ring has 20 cutting edges. The high tonnage output of Americans at slow power-saving speeds is attained by the rapid reducing action of the multiple cutting edges of the rows of rings on the rotor as shown above.



The compactness of design and construction of American Type "S" Rolling Ring Crushers makes for a complete, high tonnage installation in minimum headroom requirements. No auxiliary crushing operations and equipment are necessary to the high performance of Americans—no extra picking and standby-cleanout labor is required.

An American Rolling Ring Crusher creates no refuse problem. Uniformly reduces ROM coal to stoker or pulverizer sizes—handling slate and pyrites and rejecting tramp iron—safeguarding against passing of large, non-crushable pieces.

There's an American to fit your operation. Capacities from 25 to 500 TPH.

The cross section at left shows American compactness of design and the exclusive shredder ring principle. Revolving on their individual shafts, the shredder rings deflect without damage from tramp iron. The crushing chamber is made up of sectional manganese steel liners. Housings are of heavy ribbed steel castings secured at dust-tight machined joints with coupling bolts. This makes for easy access to all crushing parts.

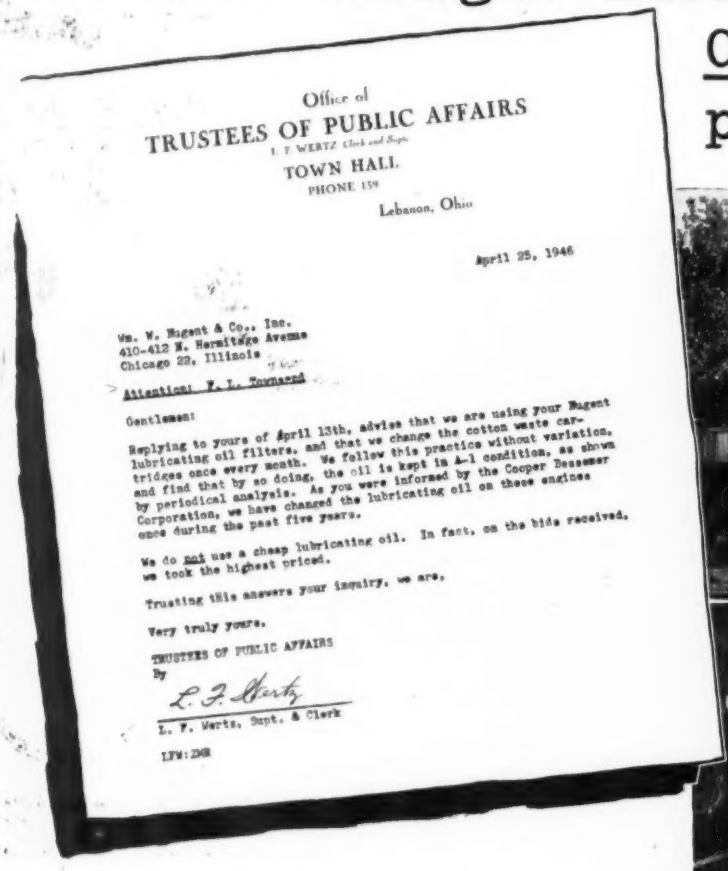
Send for bulletin: "Crushing Coal for Less Than 1c per Ton."

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1429 Macklind Ave.
St. Louis 10, Mo.

"We have changed lubricating oil only ONCE during the past FIVE YEARS"



Office of
TRUSTEES OF PUBLIC AFFAIRS
L. F. WERTZ Clerk and Supt.
TOWN HALL
PHONE 159
Lebanon, Ohio

April 25, 1946

Wm. W. Nugent & Co., Inc.
410-412 N. Hermitage Avenue
Chicago 22, Illinois

Attention: F. L. Townsend

Gentlemen:

Replying to yours of April 13th, advise that we are using your Nugent lubricating oil filters, and that we change the cotton waste cartridges once every month. We follow this practice without variation, and find that by so doing, the oil is kept in A-1 condition, as shown by periodical analysis. As you were informed by the Cooper Bessemer Corporation, we have changed the lubricating oil on these engines once during the past five years.

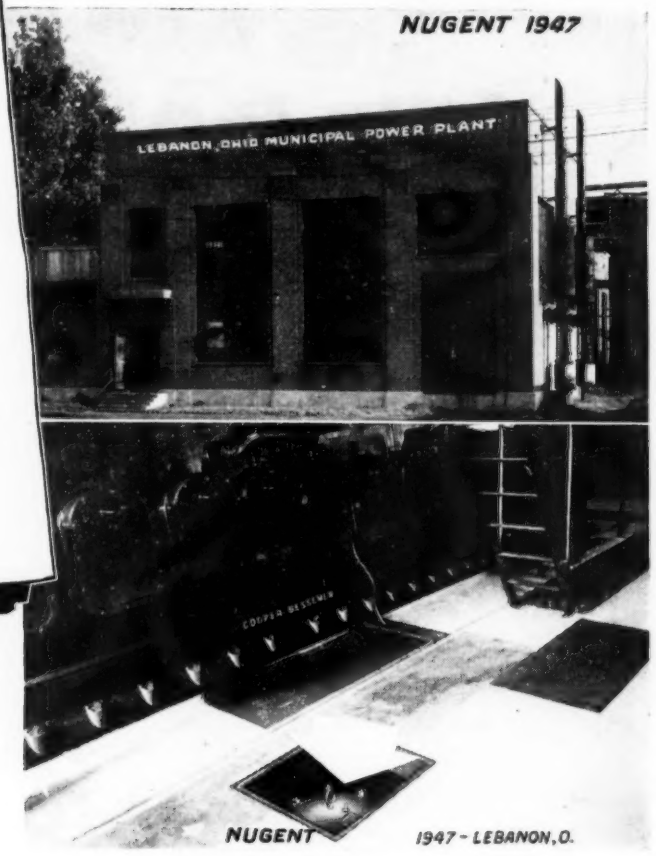
We do not use a cheap lubricating oil. In fact, on the bids received, we took the highest priced.

Trusting this answers your inquiry, we are,

Very truly yours,

TRUSTEES OF PUBLIC AFFAIRS
By
L. F. Wertz
L. F. Wertz, Supt. & Clerk

LFW:ZMB



. . . thanks to the efficiency of

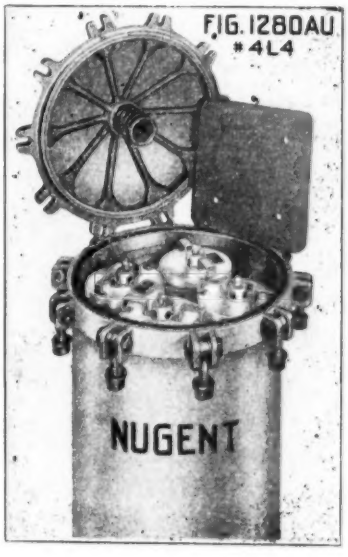
NUGENT FILTERS!

The letter reproduced above is a tribute to the ability of Nugent Filters to keep lubricating oil really clean and serviceable . . . to the extent that it was necessary to change oil only once in five years.

Power for this municipal installation at Lebanon, Ohio, is furnished by two 1000 H. P. Cooper-Bessemer Diesels, each of which is equipped with a Nugent Absorbent Type Filter (indicated by arrow, above, and close-up at right). This filter, only one in the complete Nugent line, contains four replaceable type cartridges for quick, easy cleaning and renewal.

It is interesting to note that this installation follows a highly efficient formula for achieving continuous, dependable Diesel performance . . . by using good oil, high quality filters, and by changing filter cartridges as often as necessary . . . thus assuring clean lube oil at all times, resulting in longer, trouble-free engine life.

Let Nugent Filter Specialists help solve your fuel and lube oil filtration problems. Write for complete details.

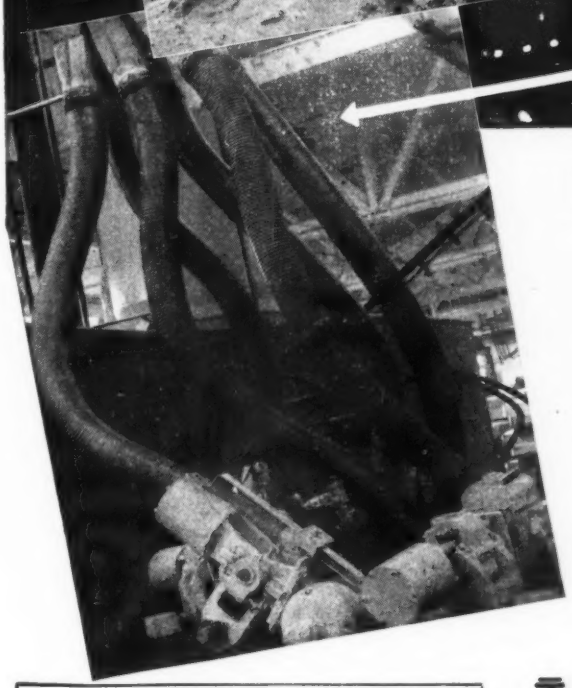


Wm. W. Nugent & Co., Inc. Mfrs.

Oil Filters, Oiling and Filtering Systems, Telescopic Oilers, Oiling Devices, Sight Feed Valves, Flow Indicators, Compression Union Fittings, Oil Pumps, Etc.

402 N. Hermitage Ave. Established 1897 Chicago, U. S. A.

FLEXONICS *at work!*



it's all

REX-TUBE

Flexible metal hose!

Three photos can show only the beginning of uses for Rex-Tube Flexible Metal Hose. And there's a good reason for this wide range utility . . . Standard Rex-Tube is made in *24 different types* of galvanized and stainless steel, brass, aluminum, and other alloys . . . in sizes from 5/32" to 12" inside diameters!

Each Rex-Tube type has been developed to handle certain applications best. CMH leadership in the science of FLEXONICS* provides the knowledge necessary to make Rex-Tube dependable and long-lasting in service, where temperature, pressure, vibration or corrosion conditions are unusually severe.

Write today for CMH Catalog G-47 . . . It gives full details on Rex-Tube — and on other CMH quality products.

*the science of FLEXONICS . . . "the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion" . . . is exemplified in the basic products of Chicago Metal Hose Corporation.

"FLEXON" *identifies CMH products, which have served industry for more than 45 years.*

CMH

CHICAGO METAL HOSE CORPORATION

Maywood, Illinois • Plants: Maywood and Elgin, Illinois

THOUSANDS OF BETTER MECHANICS

Save time... Cut Costs

with TOLEDO THREADERS

More and more today—modern living depends on *pipe*! In large buildings, from 6 to 13 types of piping systems may be required. Plants and factories need continuous supplies of water, gas, oil, air and other piped materials. Everywhere—pipe makes possible better living.

Everywhere—better mechanics depend on TOLEDO Pipe Tools to install and maintain big or little jobs. For nearly half a century, Toledo Threaders have been preferred by the man on the job . . . for perfect threads . . . with less effort . . . and lower cost. To do the job *right*—depend on TOLEDO for all Pipe Tool requirements! The Toledo Pipe Threading Machine Company, Toledo, Ohio. New York Office, No. 2 Rector Street Building.

RELY ON THE LEADER

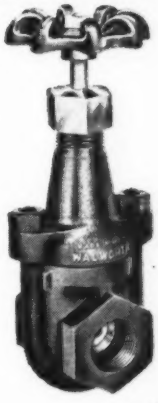
TOLEDO

FOR PRECISION PIPE TOOLS

Toledo SIMPACT — self-contained, adjustable threader for 1" to 2" pipe. Sizes changed instantly with one set high speed steel dies. Accurate, dependable.

Service Ratings			
Type	Size	Pounds per square inch	
		Steam	Non-Shock Cold WOG
Screwed	¼"–2"	150	225
	2½"–4"	125	175
Flanged	1"–2"	125	200
	2½"–4"	125	175

Fig. 709 Saddle Style — Inside Screw — Bronze Mounted or All Iron



Walworth

iron body wedge gate valves

...the last word in Dependability

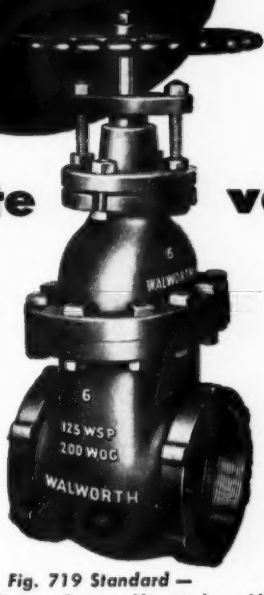


Fig. 719 Standard — Non-Rising Stem — Bronze Mounted or All Iron

Service Ratings			
Type	Size	Pounds per square inch	
		Steam	Non-Shock Cold WOG
Screwed or Flanged	2"–12"	125	200
	14" and larger	125	150

Fig. 726F Standard — Outside Screw and Yoke — Bronze Mounted or All Iron

Service Ratings			
Type	Size	Pounds per square inch	
		Steam	Non-Shock Cold WOG
Screwed or Flanged	2"–12"	125	200
	14"–16"	125	150
	16" and larger	*	150

* For steam service requiring valves 18" and larger we recommend the use of Walworth 150-Pound Cast Steel Valves.

Walworth Fig. 709 Saddle Gate Valves are recommended for lines carrying sludge, and fluids of high viscosity. They are easy to take apart, clean, and put together. They are available in either bronze mounted or all iron types, screwed or flanged ends. Two holes inside the bonnet of bronze mounted valves permit draining when the valves are open, thus eliminating the risk of damage to the valve due to freezing. All parts are designed for maximum service and strength.

Walworth Fig. 719 Standard Non-Rising Stem Valves are recommended for general service. The bronze mounted valves are furnished with bronze stems, seat rings, and disc faces. The all iron valves have nickel-plated steel stems, integral disc faces, and renewable screwed-in seat rings. Non-rising stems make them suitable for use where clearance is a factor. When the valves are open, the disc is clear of the fluid passageway.

Walworth Fig. 726F Standard OS&Y Valves are especially recommended for steam and services above atmospheric temperature. Their streamlined ports permit smooth, easy flow.

For further information about Walworth Iron Body Valves, as well as Walworth's *complete line* of valves, fittings, and flanges, see your nearby Walworth distributor, or write:

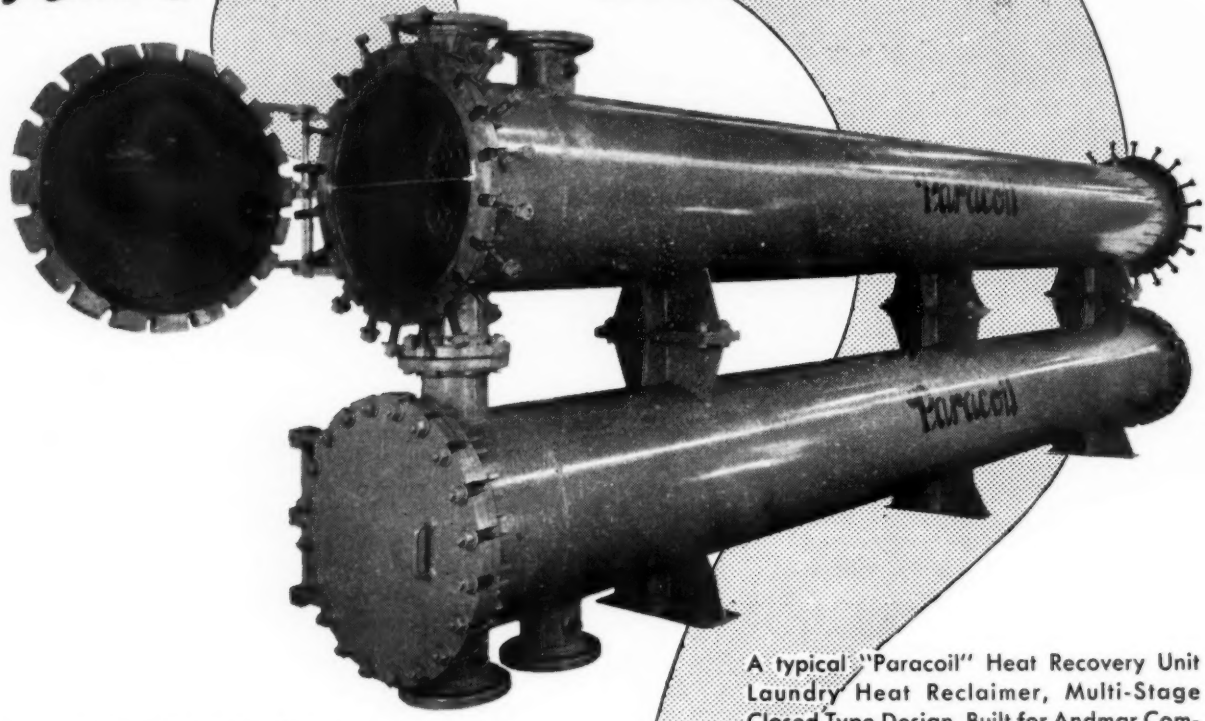
WALWORTH

valves and fittings

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

What Price B.T.U.



A typical "Paracoil" Heat Recovery Unit Laundry Heat Reclaimer, Multi-Stage Closed Type Design. Built for Andmar Company, Engineers, New York.

Every steam plant in America—regardless of size and type, or nature of fuel—is faced with the certainty of rising fuel costs. Increased labor charges at mine and well, coupled with higher railroad and marine transportation tolls, indicate an inevitable upward trend in the cost of B.T.U.'s delivered.

PARACOIL HEAT EXCHANGERS have been fighting this tendency for years, by reducing fuel costs through recovery of waste heat. Wherever hot liquids or gases are being allowed to go to waste, there "PARACOIL" can do a fuel saving job, often at remarkably low initial cost.

"PARACOIL" EXCHANGERS for Waste Heat Recovery are available as:

BOILER BLOWDOWN EXCHANGERS · DIESEL EXHAUST GAS WASTE HEAT BOILERS* · WASTE CONDENSATE COOLERS LAUNDRY WASH-WATER RECLAIMERS · FEED WATER HEATERS PROCESS WASTE HEAT RECLAIMERS · LIQUID TO LIQUID EXCHANGERS · GAS TO LIQUID EXCHANGERS

*For those particularly interested in the recovery of waste heat in Diesel Engine Exhaust Gases, we have available our BULLETIN NO. 301. Copies will be sent to anyone writing on his company letterhead. We *solicit your inquiries.*

DAVIS
ENGINEERING CORPORATION
1064 East Grand Street, Elizabeth 4, N. J.
SAVE WITH "PARACOIL"

Headquarters for the

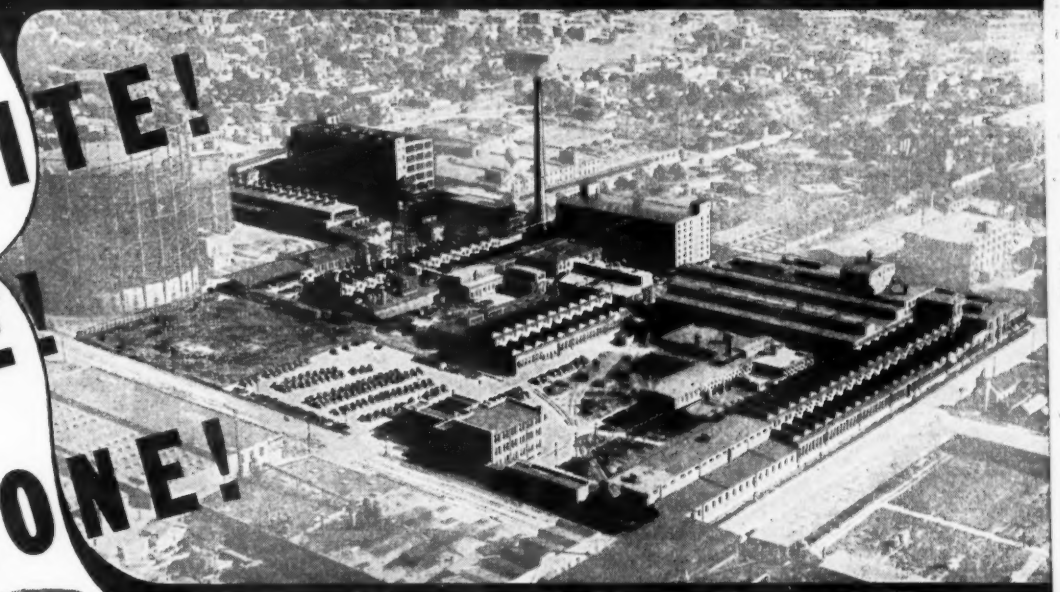
MOST COMPLETE LINE

of DROP FORGED STEEL VALVES, FITTINGS & FLANGES

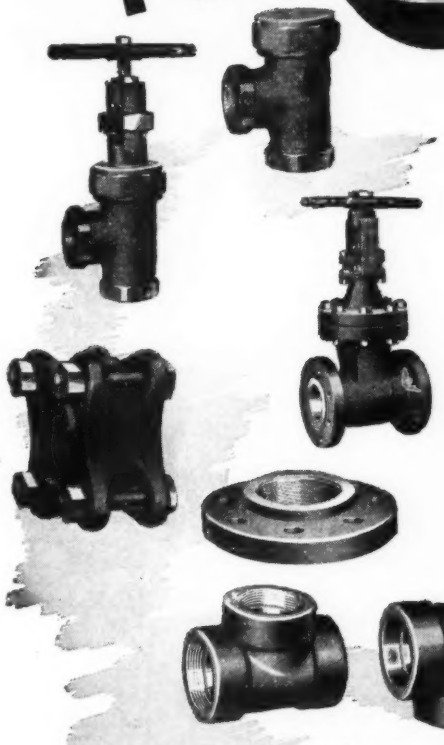
WRITE!

WIRE!

PHONE!



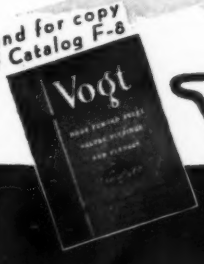
Air View of Henry Vogt Machine Co. Plant, Louisville, Ky.



VOGT provides one convenient, economical source of supply with the most comprehensive line of drop forged steel piping materials anywhere available to industry. Here will be found everything needed for the safe and efficient control of oil, steam, water, air, gas, and ammonia at high or low pressures and temperatures.

More drop forged steel Valves, Fittings and Flanges are made by Vogt, and deservedly so, because Vogt makes them better!

Send for copy of Catalog F-8



HENRY VOGT MACHINE CO.
INCORPORATED
Louisville 10, Ky.

Branch Offices: NEW YORK • PHILADELPHIA
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Vogt

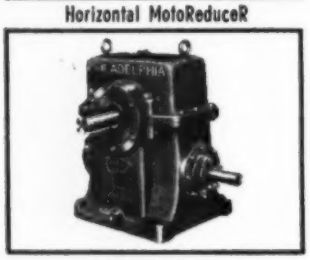
DROP FORGED STEEL VALVES, FITTINGS AND FLANGES

THESE PHILLIE GEAR REPRESENTATIVES

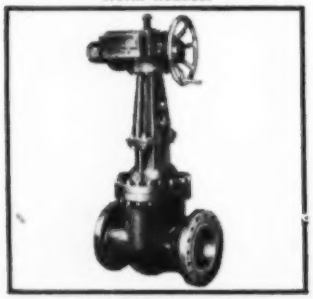
are always ready to help you . . .

Herringbone Reducer

Horizontal MotoReduceR



Worm Reducer



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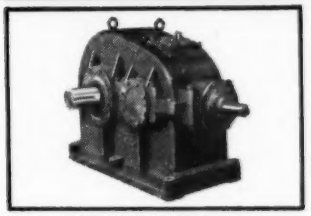
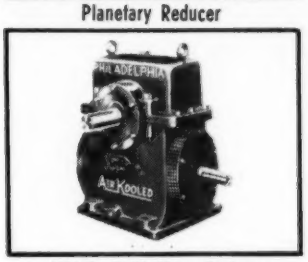
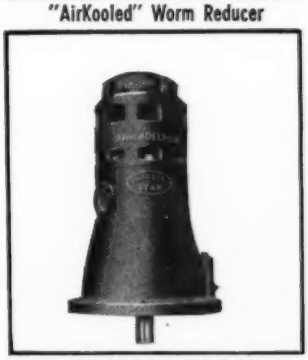


Spiral-Bevel Reducer

Planetary Reducer



"AirKooled" Worm Reducer



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. . . they're a vital part of "Phillie Gear's" nationwide service to Industry.

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Industrial Gears and Speed Reducers
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Planning for... Still Higher Pressures? Still Higher Temperatures?

WHY NOT?

Temperatures and pressures measured only in hundreds were called "high" in power plant practice not so long ago. No doubt the high pressures and temperatures now in use were talked about then, but the practical boys said, "We don't need them. Besides, they aren't practical."

As time passes the new needs, new materials and new techniques which we theorize about today will be accepted as practical. When your plans require power piping to carry higher and still higher pressures and temperatures, Blaw-Knox will be prepared to fabricate and install it.

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Operating Cost Savings

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- ★ Efficient Operation
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- ★ Low Maintenance
- ★ Long Trouble-Free Life

Careful and expert preliminary engineering work by Navco Engineers, in addition to employing the most modern fabricating and erection methods, are your guarantee of operating savings.

Consult Navco for just a Pipe Bend, or a complete Piping System.

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Good Water

COMES FROM GOOD EQUIPMENT!

But good equipment alone may not be a complete solution to your water treatment problems.

CHOOSING the right equipment and the right process for conditioning your boiler feedwater make-up are both of highest importance. Correct application depends on such factors as the character of the raw water, amount of makeup, type of steam load and design characteristics of steam generators and prime movers.

Allis-Chalmers engineers can supply valuable aid in such a selection. They have had extensive experience in conditioning boiler water for both high and low pressure power plants. In addition, their recommendations will be unbiased, because Allis-Chalmers offers a complete line of equipment that includes Hot and Cold Process Softeners, Sodium and Hydrogen Zeolite Softeners, Degasifiers, Deionizers, Chemical Proportioners, Filter Backwash Pumps, and Oil and Water Filters.

For prompt assistance with any water conditioning problem, call your nearest A-C office or write ALLIS-CHALMERS, MILWAUKEE 1, WIS.

A 2316

Shown above is sectionalized view of filter tank. Send today for complete details of Hot Process Softeners in Bulletin 28B6611.

ALLIS·CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

1847 1947
A CENTURY OF SERVICE to Industry THAT MADE America Great

One of a series *of messages to help you increase your understanding of business paper advertising, and its effect on your business.*

Why you and your advertising manager are partners

FROM WHERE YOU SIT, advertising may look like the "glamour department" of your company—necessary, of course, but pretty far removed from the hard-headed realities of the production line.

But take a closer look. In one respect, the advertising manager's job bears a striking resemblance to your own.

You're production-minded. You're concerned with anything that will improve plant procedures, speed up assembly time, prevent waste, and reduce the manufacturing cost per unit.

And that is precisely where you walk arm-in-arm with your advertising manager. Because he thinks the same way about the *manufacture of a sale.*

The whole process of selling and distribution are his assembly line. And every time he can reduce the unit cost of a sale by so much as a few cents, he increases your company's chance to show a profit.

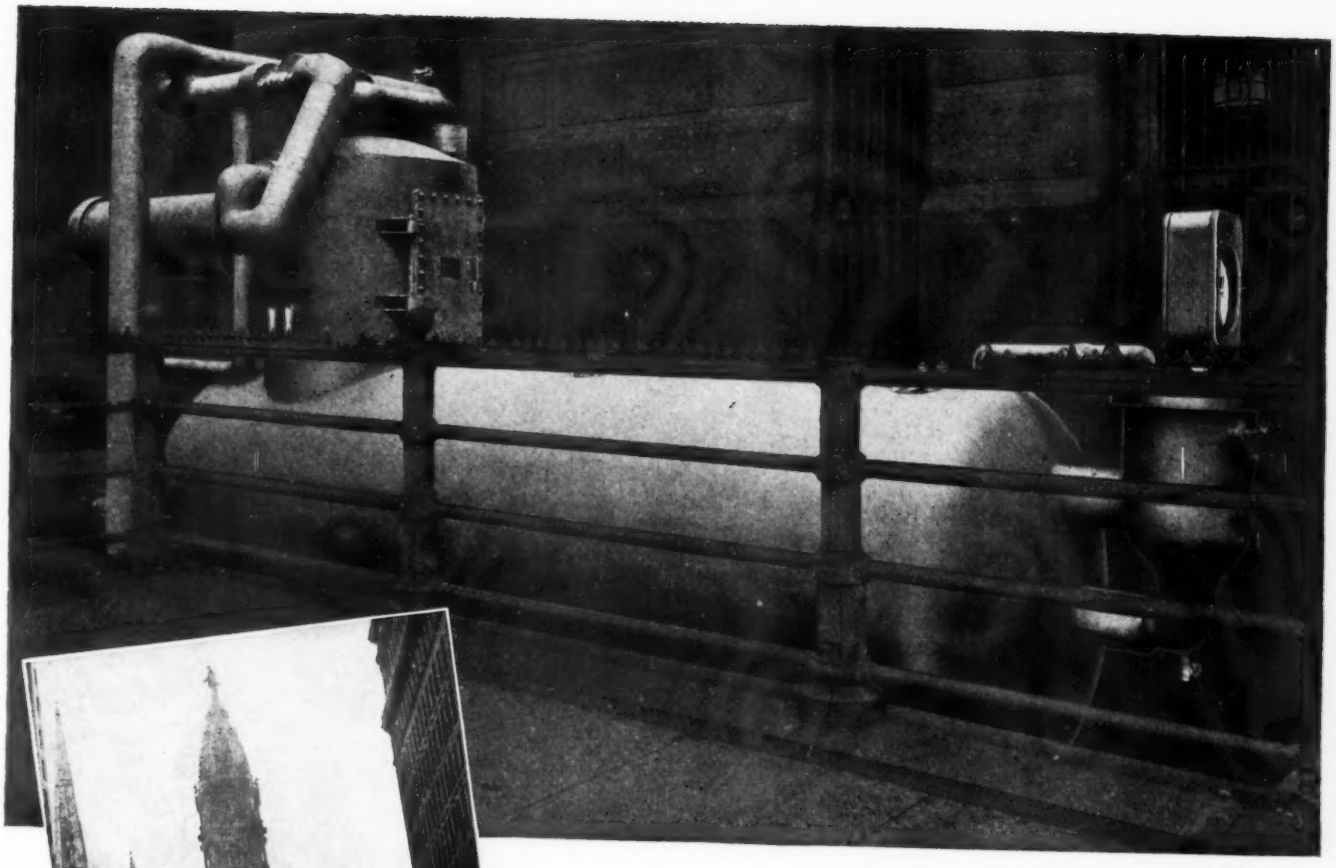
Ask him for a definition of advertising, and he will probably tell you that it is simply *mechanized selling,* a machine that multiplies the productive capacity of the sales force — seeking out prospects, arousing their interest, creating a preference for the things your company makes.

And when it is concentrated among the hand-picked readers of business papers, advertising becomes the most efficient machine this partner of yours has found for lowering the cost of producing a sale.

What are the ten ways to measure the results of your business paper advertising? You'll find the answers in a recent ABP folder, which we'll be glad to send you on request. Also, if you'd like reprints of this advertisement (or the entire series) to show to others in your organization, you may have them for the asking.

POWER

is one of the 129 members of The Associated Business Papers, whose chief purpose is to maintain the highest standards of editorial helpfulness—for the benefit of reader and advertiser alike.



UNDER BILLY PENN'S HAT

Out-of-doors installation of Cochrane Metering Deaerator added to expanding power plant of Philadelphia's famous City Hall . . . replaces smaller heater operated since 1914.

PHILADELPHIA'S City Hall, topped by its gigantic statue of William Penn towering over the crossroads of downtown Philadelphia, is an astonishing piece of engineering.

Started over seventy years ago, at a time when such an undertaking represented daring equivalent to the building of the United Nations Center of today, this monumental structure has been growing internally to meet the expanding requirements of the metropolis it governs.

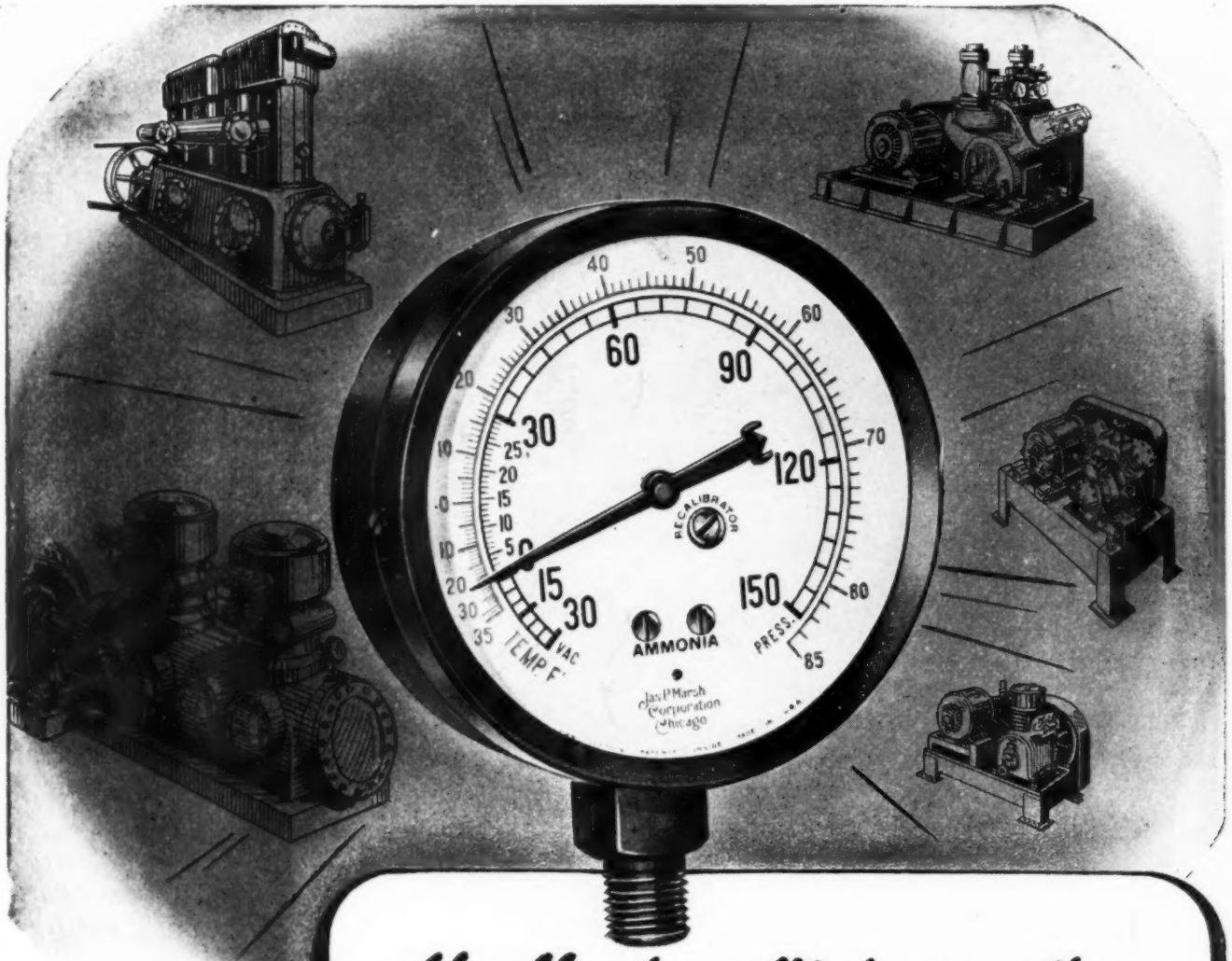
Thirty-three years ago a Cochrane Open Heater was installed in the City Hall power plant. The long satisfactory service rendered by this apparatus resulted in the installation of the latest type of Cochrane Metering Deaerating Heater in the power plant's recent expansion. Lack of space, however, made it necessary to place it out in the central courtyard at the foot of the tower with its famous statue of Penn, as shown in the photograph above.

This equipment has a deaerating capacity of 75,000 lbs/hr, with a horizontal rolled plate storage tank, and a Cochrane V-notch Weir Meter to measure the flow of water to the boiler.

Whether the boiler plant be new or old, the wise engineer will entrust the conditioning of the feedwater (to prevent scale and corrosion) to Cochrane Water Conditioning Equipment.

COCHRANE CORPORATION
3106 N. 17th Street • PHILADELPHIA 32, PA.

COCHRANE
SINCE 1863
DEAERATORS



Yes, Marsh quality has won the REFRIGERATION *field, too—*

If you know Marsh quality, it won't surprise you to find that Marsh Pressure Gauges are preeminent in the refrigeration industry. The current census clearly shows that more manufacturers of refrigeration compressors equip their units with Marsh Gauges than any other make. And numbered among these users are the big names in this exacting industry where precision and stamina are a mandate.

You could ask for no higher testimonial to Marsh quality than this, yet Marsh Gauges have written a similar story into the records of every industry where pressure gauges are used. In the applications where the going is toughest — where the needs are most critical — Marsh is the gauge chosen by the most discriminative manufacturers to become a vital part of their equipment.*

Keep this in mind when you select pressure gauges—or equipment requiring gauges. Insist on the instrument that has proved first choice of industry for the most critical services.

Jas. P. Marsh products include: A full line and range of gauges in pressure, compound, altitude, hydraulic, sprinkler, ammonia, ounce-graduated retard, test, and diaphragm types. Dial thermometers in rigid stem and remote reading types. *Ask for literature.*

JAS. P. MARSH CORP., DEPT. F., Skokie, Illinois

Export Dept.: 155 E. 44th St., New York 17, N. Y.

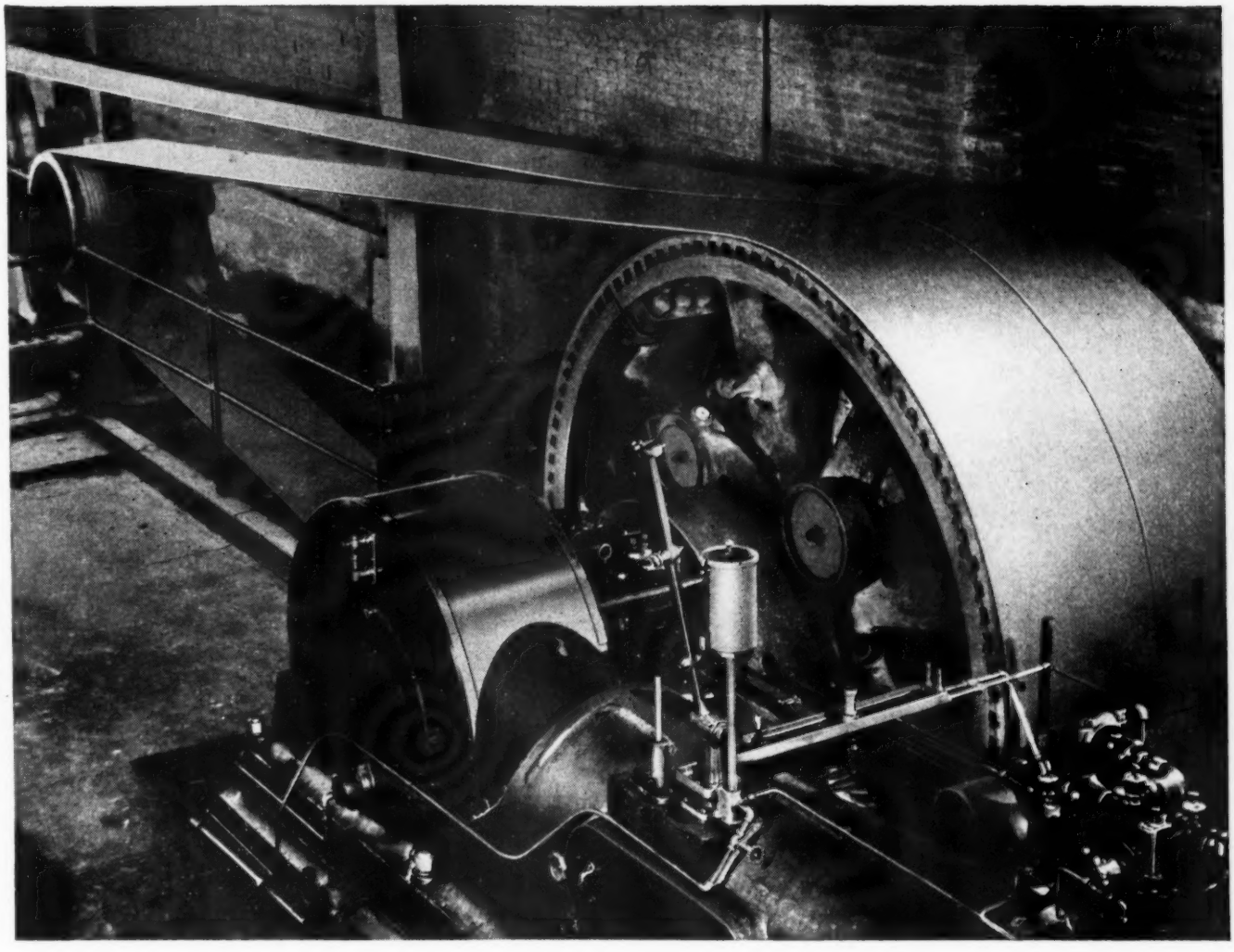
MARSH GAUGES

"THE STANDARD OF ACCURACY"

MARSH ALONE HAS THE "RECALIBRATOR"

. . . quickest and best way to correct a gauge that has been knocked out of adjustment by improper handling.

*One of a series of advertisements citing examples of this.



This new belting really turns the wheel

No wonder!

It's new Monarch Amber Transmission Belting! And it's made by Hewitt *to assure maximum power delivery from drive pulley to driven pulley.*

This means lower power costs for you. When you use this belting, power isn't wasted by belt slippage. You see, even when you're running at peak capacity Monarch Amber Transmission Belting will deliver full power.

More than that, this extremely flexible belt will not stretch out of shape. That's because only premium-grade, extra-hard silver duck is used in its construction.

You'll find that this straight-edge belt will last longer on the job, too. It's built to resist moisture, mildew and grit . . . to withstand severe stresses and shock power loads. All plies are embedded—completely insulated—with highest quality pure gum rubber compounds.

So when you want a belting that really turns the wheel in your power plant, insist on Monarch Amber Transmission Belting. Your Hewitt distributor can tell you all about it. Phone him. He's listed in the yellow pages of your telephone directory. Or write Hewitt Rubber Division, 240 Kensington Ave., Buffalo 5, N. Y.

You can count on your industrial supply specialist

He's always ready to serve you. And he knows your job . . . your operations . . . your problems. Call on him at any time for advice. He'll recommend the exact Hewitt product especially designed to help *improve* the efficiency of your operations.

HEWITT-ROBINS INCORPORATED

HEWITT RUBBER
DIVISION
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INDUSTRIAL HOSE • BELTING • PACKING

Monarch Amber Transmission Belting

PIPE REAMING
NOW MADE
fast, safe, easy

The RIDGID extra-long-taper does the trick—saves you time, muscle and pipe

● You ream pipe fast and easily with this extra efficient long-taper RIDGID reamer. Long-taper prevents thinning, flaring or splitting pipe or conduit. Even on hurried work you whisk out burr cleanly with a few light ratchet strokes, leaving pipe clean and unmarred. Comes complete with ratchet handle — or will fit your RIDGID No. 00R threader handle. Save pipe, time and work. Buy it at your Supply House.

Reamer unit alone may be bought for your RIDGID No. 00R threader handle.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

YOU'RE ALWAYS SURE
With A LIQUIDOMETER Tank Gauge

WRITE for COMPLETE DETAILS

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

THE LIQUIDOMETER CORP.
39-16 SKILLMAN AVE., LONG ISLAND CITY, L.N.Y.

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Control

AIR, WATER, GAS, STEAM, LIGHT & HEAVY OILS, REFRIGERANTS, etc. Suitable for pressures up to 1000 pounds and temperatures up to 400° F.

Internal valve assembly can be removed for cleaning and inspection if necessary. Two-wire—A.C. or D.C.—current failure — packless construction — bronze body — stainless steel and bronze internal parts—soft seats available.

SIX TIMES THE POWER of ordinary solenoid valves. This feature assures high seating pressure and overcomes the effect of viscous fluids, such as heavy fuel oil. Adequate power of solenoid insures positive operation. Normally closed or open types available.

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GENERAL CONTROLS
801 ALLEN AVENUE GLENDALE 1, CALIF.
Manufacturers of Automatic Pressure, Temperature & Flow Controls

FACTORY BRANCHES: BIRMINGHAM (3) • BOSTON (16) • CHICAGO (5) • DALLAS (2) DENVER (10) • DETROIT (8) • CLEVELAND (13) • HOUSTON (2) • KANSAS CITY (2) NEW YORK (17) • PHILADELPHIA (40) • PITTSBURGH (22) • SAN FRANCISCO (7) • SEATTLE (1)
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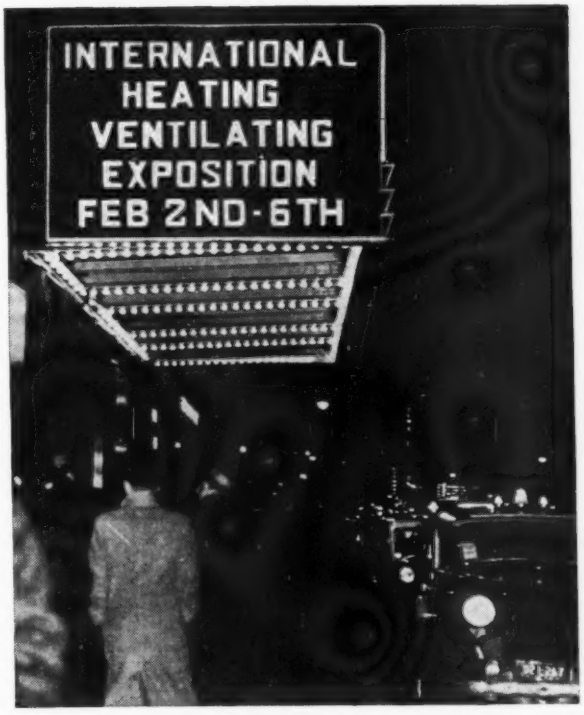
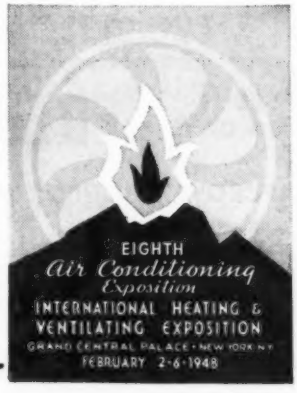
Portals to Progress



. . . in AIR CONDITIONING–HEATING–VENTILATING

Come to Grand Central Palace . . . New York City . . . February 2 to 6!

Assembled here you'll see over 350 arresting displays and demonstrations of the newest and best ways to heat, ventilate and condition air in all types of industrial plants. Here in less than a week's time you can study and compare first-hand the relative merits of everything from complete units to maintenance supplies—in the light of your office and factory needs . . . discuss your problems and plans with technical attendants at the booths—men on hand expressly to help you with your problems, tell you what you want to know to keep abreast of the trends and practices in these active fields.



The wealth of worthwhile stimulating ideas, information and contacts at this exposition may save you much time, trouble and expense.

Plan now to attend—have your associates come too. Mark the date.

Under Auspices of American Society of Heating & Ventilating Engineers

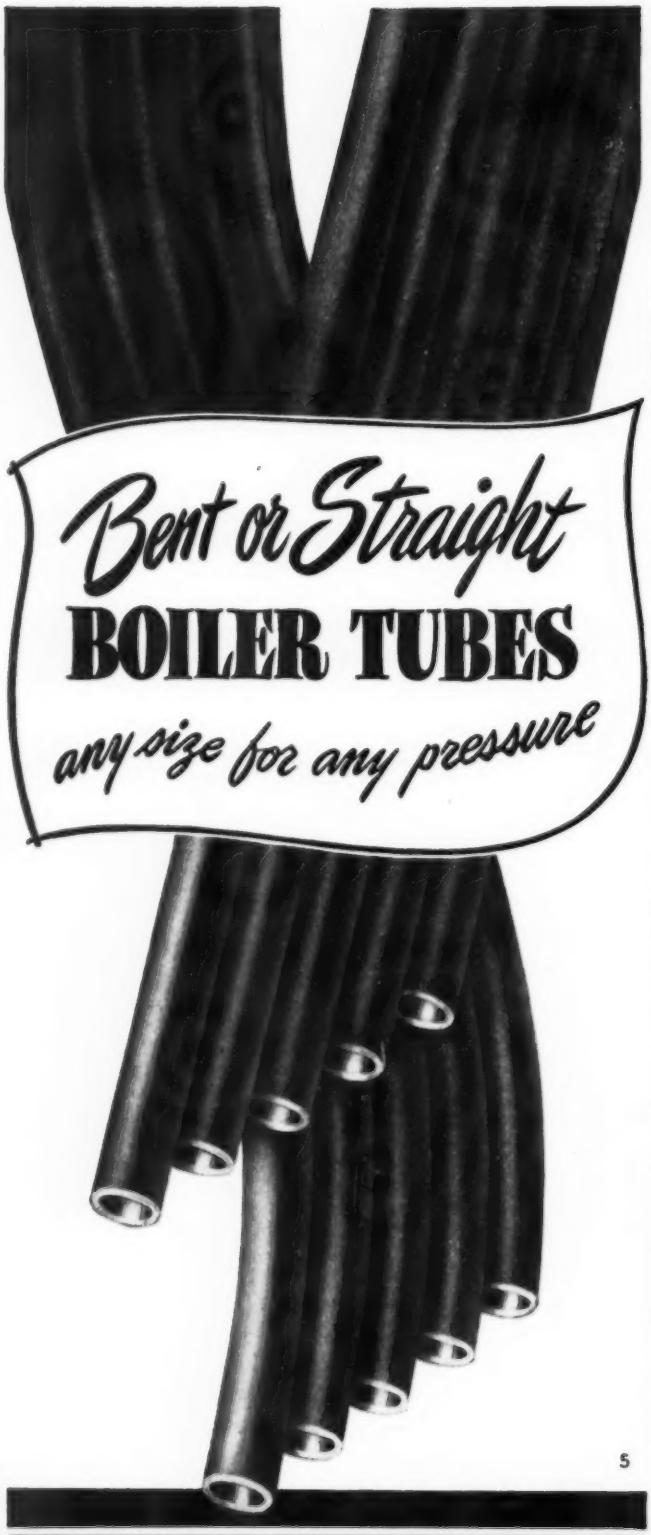
8th Air Conditioning Exposition

Only RIGID pipe wrenches give you these 5 valuable features

1) Housing guaranteed against breakage or distortion — no repair expense, ever; **2)** Adjusting nut in open housing spins freely in all sizes; **3)** Handy pipe scale on hookjaw; **4)** Instant-action non-slip non-lock jaws; **5)** Powerful comfort-grip I-beam handle. All this adds up to fast, easy work and real pipe wrench economy, too. RIGID heavy-duty pipe wrenches, sizes from 6" to 60," are available at your Supply House.

RIGID *strap wrench won't mar polished pipe or tubing.*

RIGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO



Bent or Straight
BOILER TUBES
any size for any pressure

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BOILER TUBE CO. OF AMERICA

McKEES ROCKS, PA. (Pittsburgh District)

PITTSBURGH • CHICAGO
FRED S. RENAULD & CO., LOS ANGELES

A practical guide to trouble-free operation of PRESSURE VESSELS

Your problems of selection, installation, operation, and upkeep of industrial pressure vessels are quickly answered in this thorough manual. Planned to bring helpful facts to those responsible for either operating pressure vessels or designing them—this book covers all types of vessels used in major industries, explains how they are constructed, their efficient uses, and safe operation. It shows you how to calculate stress and pressure, gives the latest methods of repair, tells how to prevent breakdowns through proper inspection and maintenance, and provides many other helpful, money-saving procedures.

Just Published!

PRESSURE VESSELS for INDUSTRY

By HARRY M. SPRING, JR.

259 pages, 242 illustrations, $3.50

Whatever type of pressure vessels your particular industry uses—compressed air, steam or hot water storage tanks, evaporators, feedwater heaters, or vessels for special processes—you will find helpful information in this handy manual. A thorough discussion of sound designs and of formulas for computing pressure shows you how to ascertain accurately what your requirements are. The book clearly explains construction and fabrication methods with cross-sectional views microphotographic analysis of surfacing and joining techniques. The main types of pressure gauges, valves, and regulators are described and illustrated to show their construction and uses. Here is your complete guide to safer, more economical operation of pressure vesels.

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1. Compressed Air Systems
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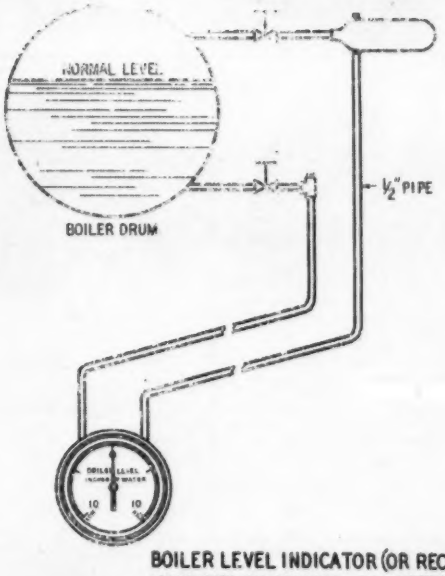
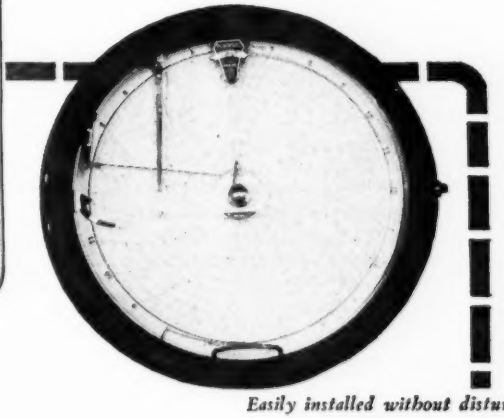
For Closer Control of Boiler Water Level



BOILER LEVEL INDICATOR (OR RECORDER) MOUNTED ON CONTROL OR INSTRUMENT PANEL

FOXBORO

LIQUID LEVEL RECORDERS provide a continuous eye-level check on regulator operations



Easily installed without disturbing gauge glass . . . can be located almost anywhere. Available with Rotax (electrically operated) for high and low emergency or safety alarm.

• **ACCURATE**, continuous records of boiler water level are always important to efficient operation of boiler plants. They double-check the operations of regulators . . . show when and for how long water was low . . . indicate exact time and duration of blowdowns and other facts pertinent to efficiency and safety.

Foxboro Recorders can be mounted anywhere in the boiler room . . . wherever operators and supervisors can see the records most conveniently. There's less chance of oversight . . . more chance for watchfulness.

Foxboro Liquid Level Recorders are made for any pressures encountered in modern steam practice. Simply, ruggedly constructed to serve many years with minimum maintenance. Though used primarily for boiler water level recording, they are also used for feedwater heater levels and other pressured vessel applications. Write for detailed information. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.**

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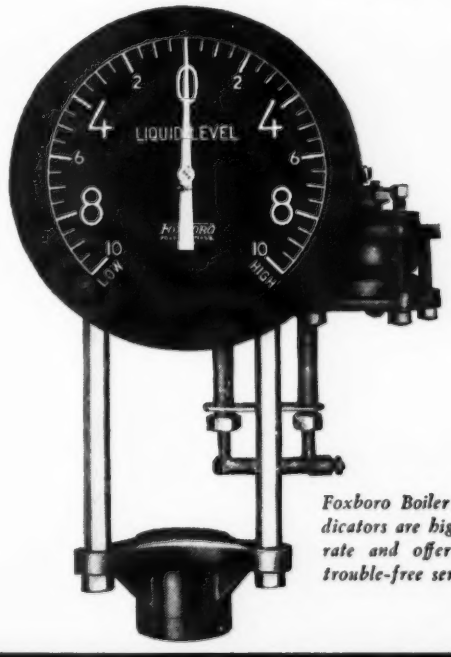

Foxboro Boiler Water Level Indicators are highly visible, accurate and offer unusually long, trouble-free service.

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● You pay a share of this tremendous loss, if you fail to protect iron and steel surfaces from the metal-consuming "fire" of rust. Yet, rust CAN be *stopped* by sealing the surface so that no oxygen can reach and oxidize it. RUST-OLEUM combats rust as effectively as water quenches fire.

For less than 1-cent per square foot you can add years of life to metal roofs, gutters, smokestacks, fire escapes, railings and fences. RUST-OLEUM will positively stop and prevent rust on all types of metal surfaces.

See your distributor or write for Catalog No. 246.

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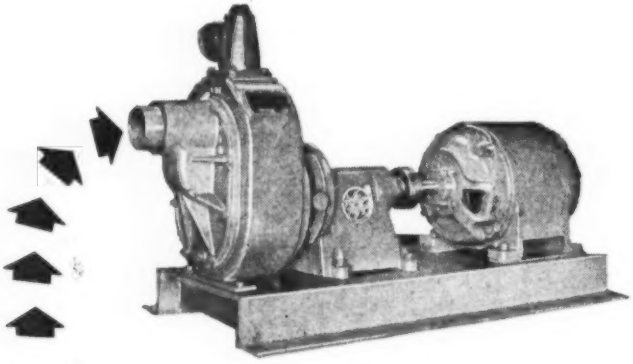
- No expensive preparation. Merely wire brush to remove scale, dirt, etc.
- RUST-OLEUM penetrates remaining rust and incorporates it within the protective film.
- RUST-OLEUM does not crack, blister or peel.
- Excellent coverage . . . Lasts longer.
- Full selection of colors.

APPLY BY BRUSH, DIP OR SPRAY

RUST-OLEUM CORPORATION
2447 Oakton Street
EVANSTON, ILLINOIS

HIGH LIFTS



Trust the pumping to a

MARLOW SELF-PRIMING CENTRIFUGAL

Placed 15, 20—as high as *twenty-five* feet above the liquid—a Marlow industrial pump primes, pumps and reprimes automatically. Marlows handle clear water, coolants, chemical solutions, volatile fluids, liquids containing abrasives . . . Capacities 25 to 3500 gallons per minute. Write for Industrial Pump Bulletin. Marlow Pumps, 592 Greenwood Avenue, Ridgewood, N. J.

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the *RIGHT* BURNER for *YOUR* JOB

TYPE "SA"

(For use where steam is available) *atomizes thoroughly* and *burns completely*, the lowest and cheapest grades of fuel oil and tar, requiring only low oil pressure and temperatures.

TYPE "SAL"

(Large capacity burner similar to TYPE "SAR") is adaptable in combination with powdered coal burners in large boilers.

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(Where steam, or gas is available, for atomizing) safely and efficiently burns residuums obtained from process.

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—the "AIROCOOL" Gas Burner in combination with a TYPE "SAR" Oil Burner.

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with multi-vane type air diffuser to give a positive swirl to entering combustion air.

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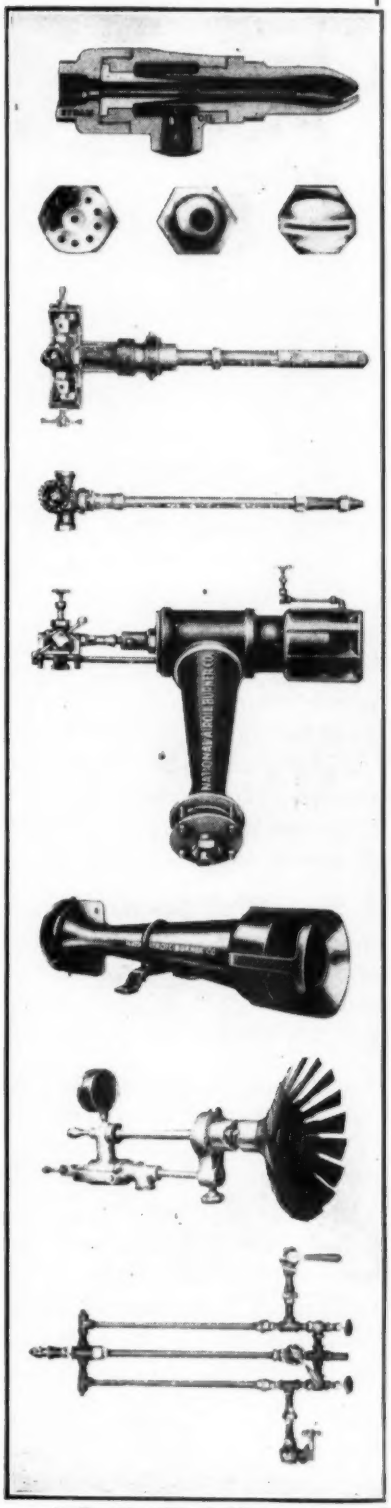
(Refuse Oil Burner) burns acids or caustic oils, sludges, asphalts, tank bottoms, polymer oils, heavy petrolatum, organic oil residuums, waste cutting oils, sulphite pulp liquors, etc.



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COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" BRASS CO. *Headquarters for BRASS, BRONZE, and COPPER*

Dezincification—What You Can Do to Prevent It

Some operators are still having trouble with dezincification, although much has been done to call attention to the benefits from new and better alloys in combating this type of failure. This is particularly true of some of the older installations where uninhibited Admiralty and Muntz metal are still in use. We hope that a brief discussion of this subject will be helpful.

Dezincification is a special type of corrosion commonly occurring in brass (copper-zinc alloys) which contain less than 85% copper, where the major part of the corrosion product consists of a local deposit (plug) or layer of porous copper. Frequently a white or colored tubercle or cap of zinc-rich salts forms directly over the area where dezincification is occurring or has occurred.

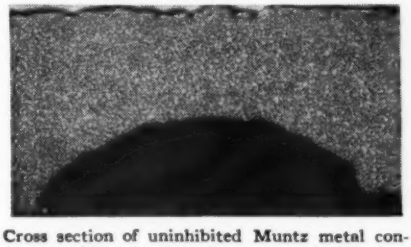
Dezincification is a familiar term which is often misused. One erroneous explanation is that brass contains particles of zinc scattered throughout the alloy and that where these dissolve, copper remains. Since the combining of copper and zinc to make brass forms an alloy in which free particles of zinc are never found even under the highest power of the microscope, such a statement is of course incorrect. It has also been said that the zinc in brass is sometimes eaten away by certain types of bacteria. This is also contrary to known facts.

Dezincification Studied for Many Years

As far back as 1921 F. de Wurstemberger[1] noted that dezincification started along the grain boundaries where zinc-rich impurities, or the beta phase, tended to segregate. G. D. Bengough and R. May[2] also studied this phenomenon and the effect of alloying elements to inhibit or accelerate dezincification. R. B. Abrams[3] (1922) and C F. Nixon[4] (1924) called attention to the fact that dezincification occurs most readily when a portion of the brass is screened from oxygen by deposits of foreign matter.

Today it is recognized that nodules of zinc-rich corrosion products taken from dezincified brass surfaces and transferred to clean brass surfaces and exposed to salt water will rapidly produce localized dezincification beneath the deposit. Other materials such as particles of rust, cotton, etc., will do the same.

Dezincification is favored by a limited supply of dissolved oxygen, the presence of certain salts, a low water velocity or stagnation, and elevated temperature. This type of failure has been observed in many different types of water. Sometimes the copper which is redeposited may form a continuous layer which is known as layer-type dezincification. When foreign matter settles or becomes attached to the walls of the brass tube or pipe, the corrosion appears as plugs of redeposited copper. This is known as plug-type dezincification. For example, uninhibited Muntz



Cross section of uninhibited Muntz metal condenser tubing showing plug-type dezincification. Mag. 25X.

metal and Admiralty tubes in a horizontal position have failed from plug-type dezincification localized in the lower half (underside) of the tube. This suggests that foreign matter settling out of the water has contributed towards initiating the attack.

Preventing Dezincification by Addition of Arsenic

A large number of investigators in recent years have shown that this reaction can be stopped or inhibited through changes in alloy composition. For example, the addition of arsenic even in concentrations as low as .005% is very effective in hindering the dezincification of Admiralty and aluminum brass. It has also been found that a larger concentration of arsenic is quite effective in Muntz metal (60-40 brass). As a result of the above, arsenical Admiralty, arsenical Muntz*, and Arsenical aluminum Brass (Cuzinal) have been standard alloys at Bridgeport for more than a decade.

Incidentally it has also been found that the addition of arsenic is beneficial in aluminum bronze. Here arsenic markedly improves the over-all corrosion resistance to sea water. This modified aluminum bronze is known as Duronze IV**. Since Duronze IV contains no zinc, this alloy is, of course, immune to dezincification.

Where dezincification has been encountered in marine services, the use of either a modified brass such as arsenical Admiralty, or arsenical Aluminum Brass (Cuzinal), Duronze IV (arsenical aluminum bronze) or 70-30 Cupro Nickel is recommended. The choice depends upon the nature and intensity of all types of corrosive attack.

Increasing Service Life of Condenser Tubing

No one condenser tube alloy is ideal for all conditions; consequently, Bridgeport offers a representative range of alloys. Bridgeport's laboratory can help operators determine which alloy will be most effective for local water and operating conditions. This service is available for the asking since Bridgeport welcomes the opportunity of cooperating closely with engineers, operators and others who are concerned with condenser tubing. We look forward to receiving correspondence from condenser and heat exchanger users, consultants and builders. Your experiences and problems will help others extend condenser tube life.

Condenser Tube Manual

Contact the nearest Bridgeport office, and in the meantime, write for 120-page Condenser Tube Manual which contains valuable information about corrosion, condenser tube alloys, and practical suggestions for increasing the service life of condenser and heat exchanger tubing.

**U. S. Pat. No. 2,118,688*
***U. S. Pat. No. 2,083,380*

[1]Rev. Met., 18,702 (1921)
[2]G. D. Bengough, Jour. Inst. Metals, 32,81-269 (1924) R. May
[3]R. B. Abrams, Trans. 1
[4]C. F. Nixon, Trans. Electrochem Soc., 44,29 (1924)

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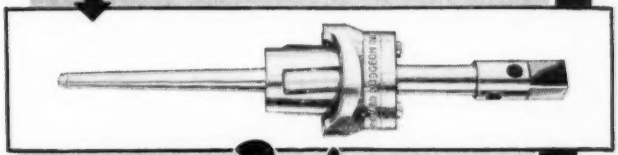

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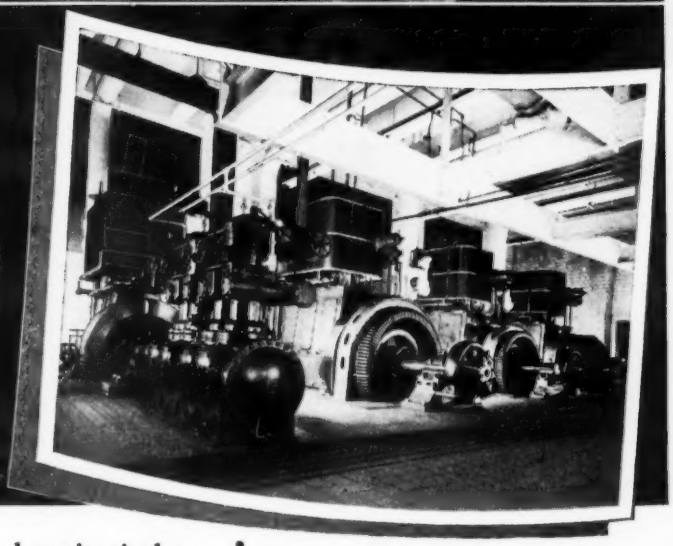

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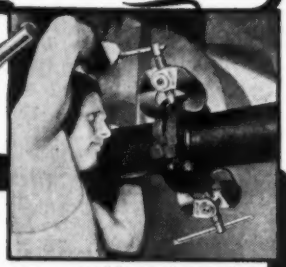

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Fig. 12

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Fig. 21 Fig. 22

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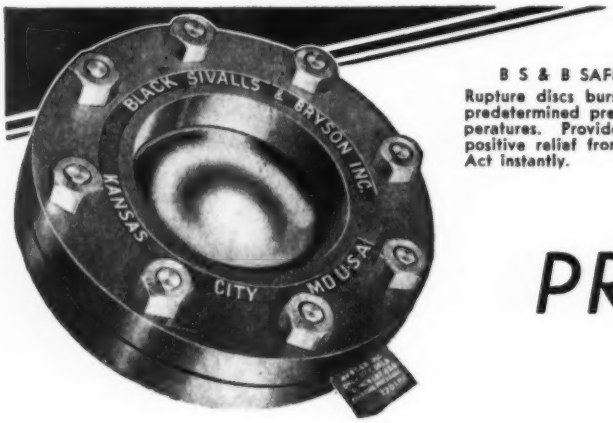

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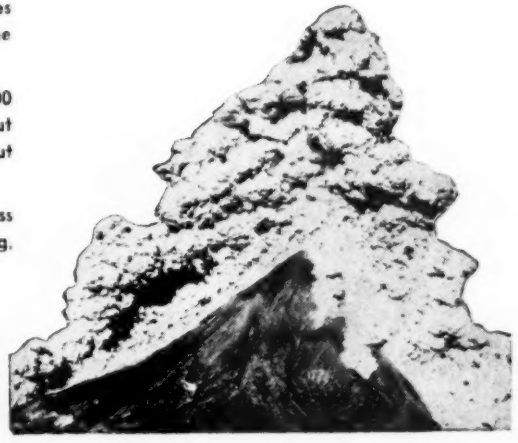

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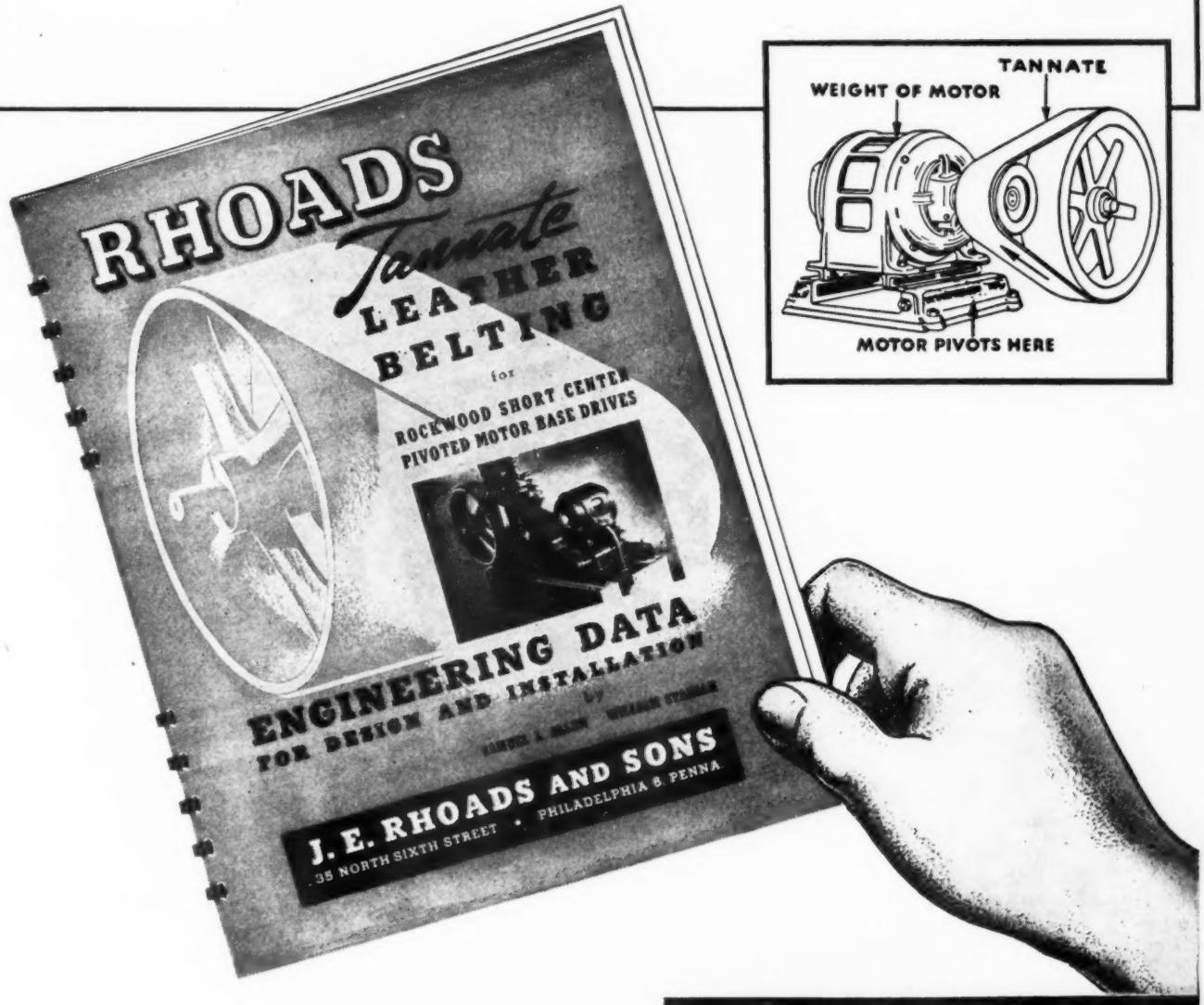

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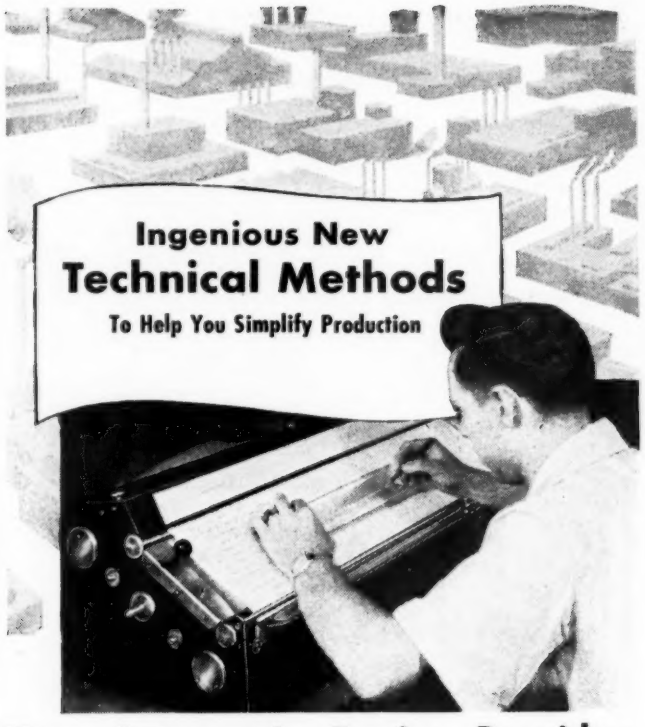

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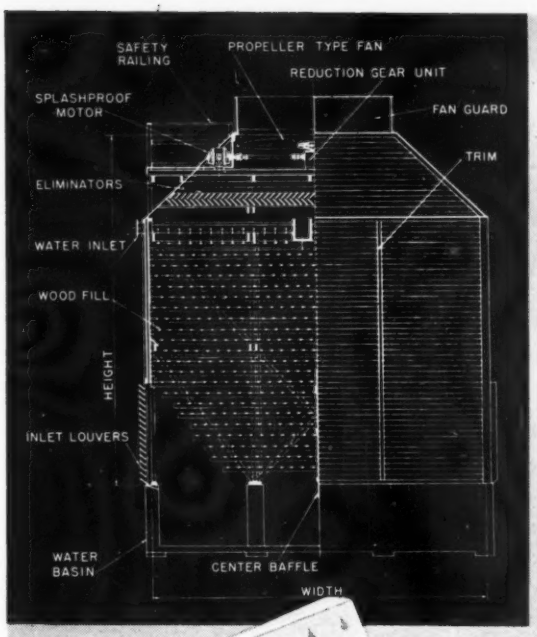

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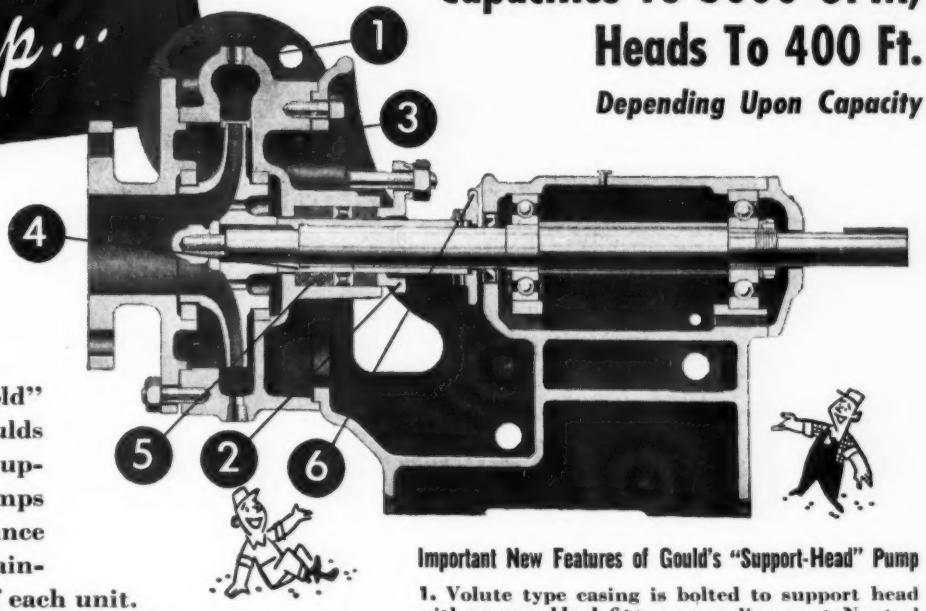

LIKE the new "Close-Cupld" announced recently, Goulds new series of ball-bearing "Support-Head" Centrifugal Pumps embody features which enhance pumping efficiency, simplify maintenance and prolong the life of each unit.

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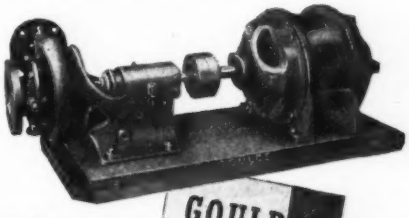

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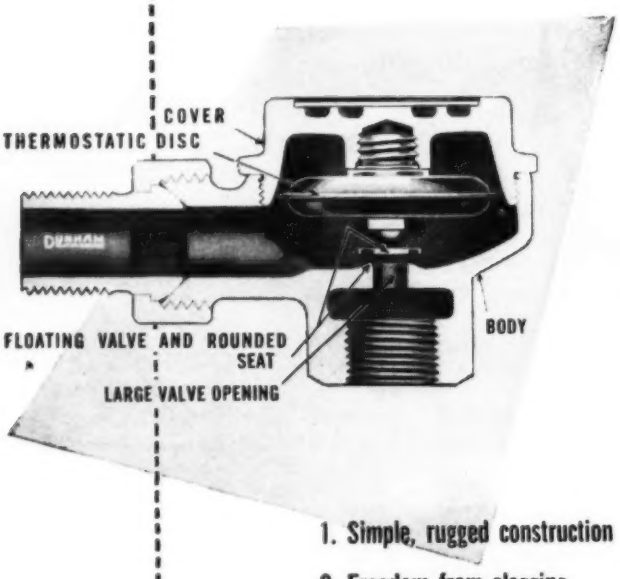

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NOT IF YOU USE DUNHAM THERMOSTATIC TRAPS

They're designed to provide efficient differentiation between steam and air-and-water, and constructed to assure continuous uniform service over a longer period of time. Dunham traps also offer permanent adjustment built into the element for correct operation. Thermostatic elements that are interchangeble without adjustment and many other engineering features. For dependability, for efficiency, for every purpose . . . ask for Dunham Traps, First Fluid Filled Thermostatic Trap "still the best."

DUNHAM HEATING MEANS BETTER HEATING P-1147-2/3-B

C. A. DUNHAM COMPANY • 450 E. Ohio St., Chicago 11, Illinois
GENTLEMEN: Send me additional information on Traps.
Name
Title
Company
Address
City Zone State

WHERE TO BUY

Featuring additional products and specialties for power plants

BIRCH Pump Valves

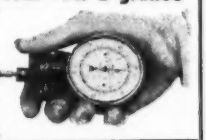
Standard in

RAILROADS, MINES, WATER WORKS INDUSTRIALS

● They increase efficiency, capacity, economy—decrease slippage, leakage, fuel consumption—will not sink in seat ports, warp, break, curl, or ride seat bridges. For hot or cold water service . . . thoroughly dependable.

BIRCH MANUFACTURING CO.
1521 Sedgwick St., Chicago, Ill.

TEST SPEEDS and SAVE.—At a glance
REVOLUTIONS and FEET per min.
SPEED VARIATIONS
BELT SLIPPAGE
Send for Bulletin



O-Z Improved Hand Tachometer-Cutmeter
O. ZERNICKOW CO.
21 Park Row New York

End Pump Troubles!
IMPROVED
HILL PUMP VALVES

● The valve with the renewable feature restores old pumps to original efficiency. Constant contact is maintained over the full bearing surface no matter in what position the valve rotates because of the exclusive HILL design. Efficient, durable, economical, accurate. Send today for bulletin that tells how to get better pump performance.

HILL PUMP VALVE CO.
2728 ELSTON AVE. CHICAGO 47, ILL.

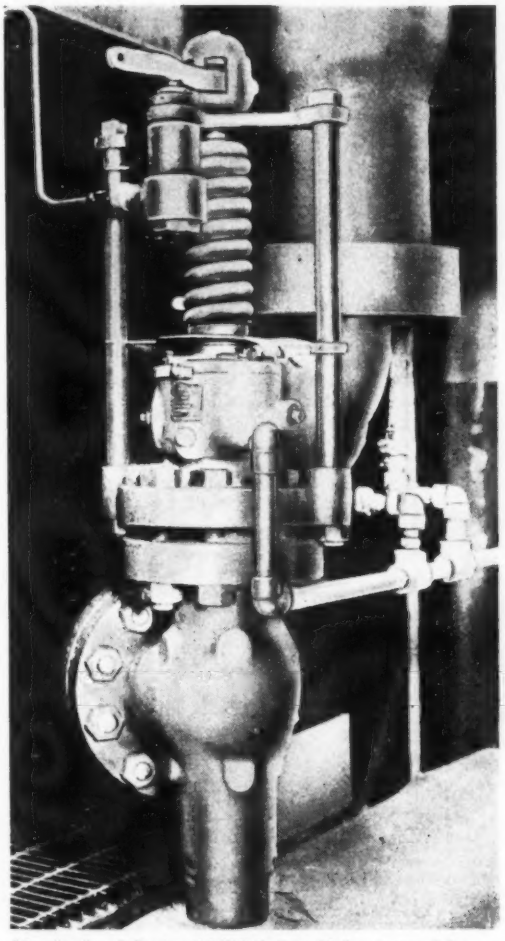
This WHERE TO BUY *Section*

supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical power operation and maintenance. Make a habit of checking this page, each issue.

Classified Advertising Division
POWER

Give Your Boilers a Break!

End Safety Valve Troubles by Installing ● FOSTER 38-SV Safety Valves with these 5 GUARANTEED ADVANTAGES:



Hundreds of Foster 38-SV Safety Valves are giving top performance in important installations. This 2½" superheater unloading valve operates at 1450 lb., 950° total temp. Others are in service up to 2575 lb. at 1000° F.

1 Built to Stay on the Job—the Foster 38-SV is the SAFETY valve that is built to pop without causing boiler outages. On accelerated tests in an Eastern Utility, one of these valves has been popped every day for more than 6 years. It has had only routine maintenance, and yet it pops consistently at set pressure, and does not leak. In the Chief Engineer's own words—this is the equivalent of at least 40 years' normal service.

2 Accurate Popping—Once set at the desired popping point, the Foster 38-SV pops on the button for each successive pop. For instance, in another Utility installation, the 38-SV under test was set for 600 lb. and popped 50 times in quick succession. The first pop was at 600 lb. and the 50th pop was at 595 lb. In spite of the heat of this abnormal operation, the Foster 38-SV was thrown off less than 1%. After a short cooling period, it again popped at 600 lb. That's test gauge accuracy!

3 Minimum Blow-down—Foster 38-SV's are adjustable so they can be set to reseat when pressure has dropped as little as 1% below the popping point. In this same test the 38-SV, on its first pop, reseated at 594 lb. for a 6 lb. or 1% blow-down. On the 50th pop, it reseated at 589 lb. which is also 6 lb. or 1%. After each pop, it reseated positively with no chattering or leakage. Only over-pressure up the stack—no useful steam wasted.

4 High Relief Capacity—Foster 38-SV's have larger bore because they can handle larger volume of steam and still control blow-down. Depending on operating conditions, they may give more than twice the capacity of other makes, as in the case of 5 Foster 38-SV's required to replace 12 "conventional" safety valves of the same nominal size. Fewer valves to buy—fewer valves to service.

5 Low Maintenance—Hot or cold, the piston in the 38-SV fits loosely and cannot stick, and yet no steam reaches the spring. The spring stays cool enough to touch, even while the valve is popping—which means longer spring life. Disc and seat expand at the same rate during heating-cooling cycles—there is no drag to destroy seating surfaces. Simmering and chattering have been eliminated as a source of destruction. Discs will not warp or crack. When routine inspection and maintenance are indicated, complete loading assembly lifts out without disturbing the spring setting.

For full details on the design and construction features that enable this valve to outperform any other safety valve, get in touch with your Foster Representative or with us direct.

FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS...PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

106 MONROE STREET • NEWARK, N. J.

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BURNS & McDONNELL ENGINEERING COMPANY
Consulting Engineers 50th Year
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Electric Systems - Rate Reports - Valuations
Water and Sewer Systems and Treatment
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Consult these Specialists
when you need professional assistance in solving difficult problems. Their specialized knowledge and broad experience can prove invaluable in saving both time and money for you.

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FLUID FLOW DEVICES
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JOHN R. McDERMET
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Corrosion
Control and Prevention
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Engineer
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OIL REFINERY EQUIPMENT
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SARGENT & LUNDY
ENGINEERS
140 South Dearborn St. · Chicago, Illinois

WHITMAN, REQUARDT AND ASSOCIATES
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THE REAL VALUE *of placing your unusual problem in the hands of a competent consultant is that it eliminates the elements of chance and uncertainty from the problem and provides real facts upon which to base decisions.*

NOW! RONAFLEX

a flexible tubing of 1001 uses

with hi-speed snap-on couplings that save time . . . cut costs . . . speed work

Here is a revolutionary new type of tubing with the flexibility of rubber . . . the sturdiness of steel. Ronaflex is a synthetic rubber tubing protected by strong steel braiding cover that provides extreme flexibility, tight free-flowing transmission of air, water, gases, oil, volatiles.

For quick, tight connection, Ronaflex tubing is available with hi-speed snap-on aluminum couplings that resist rust, prevent leakage, save time. Simply snap on, snap off—a one-second operation! Precision-made, they withstand severe vibration and pressures up to 500 p.s.i. without leakage.

Designers, engineers, plant managers will find Ronaflex tubing assemblies ideal for economical use everywhere: fuel and oil lines for engines, machine tool coolant lines, butane-propane gas lines, paint spraying air lines, for rapid testing operations, and countless other applications. Write for complete data. Ronaflex tubing assemblies, manufactured by the Ronaflex Tubing Co., Inc., are distributed exclusively by . . .

PENFLEX SALES COMPANY
Division of
PENNSYLVANIA FLEXIBLE METALLIC TUBING COMPANY
7238 Powers Lane Philadelphia 42, Pa.
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Penflex... HEART OF INDUSTRY'S LIFE LINES

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SEARCHLIGHT SECTION

POSITION VACANT

Test Engineer under 25 years of age for modern pulverized coal fired steam electric generating station in Middle West. Experience or educational background such that he can be trained to make boiler water analyses, boiler and turbine tests and miscellaneous plant tests. State salary required.

P-1529, Power
520 North Michigan Ave., Chicago 11, Ill.

WANTED
POWER PLANT MECHANICAL ENGINEERS

Thoroughly experienced in design of modern plants and qualified to supervise engineering staff. Annual salary in neighborhood of $10,000. Location in greater New York area. Give full details of education, experience, age, availability, willingness to travel, etc.

P-1317, Power
330 West 42nd Street, New York 18, N. Y.

WANTED
By Oil Company in Texas

Man under thirty-five (35) experienced in water treatment, testing and control for high pressure boiler plant in Southwest Texas. Plant is part of Natural Gasoline Processing Plant. Degree not essential but experience absolutely necessary along lines required. Give complete details as to experience and qualifications, salary expected and availability in first letter.

P-2144, Power
520 North Michigan Ave., Chicago 11, Ill.

WANTED
ENGINEERS

Wanted by Michigan firm of engineers, men qualified for structural and mechanical design, drafting, and construction supervision on power plant work. Answer to

P-276, Power
520 North Michigan Ave., Chicago 11, Ill.

MECHANICAL ENGINEER
WITH 15 TO 20 YEARS EXPERIENCE
In The Design of Steam Electric Generating Stations
FOR ADMINISTRATIVE POSITION
With a Large Eastern Utility

P-335, Power
330 West 42nd Street, New York 18, N. Y.

CHIEF ENGINEER
WANTED

Chief Engineer for well known established firm of Engineers & Constructors. Prefer man with 15 to 20 years mechanical and process experience in Petroleum, Refining Chemical and Power to organize and direct engineering work with complete responsibility. Excellent salary and bonus arrangement. Location—Midwest.

P-1935, Power
520 North Michigan Ave., Chicago 11, Ill.

POSITIONS VACANT

ELECTRICAL ENGINEERS with some experience in substation and power plant design. Pleasant working conditions. Location in ideal home community. Write Electrical Engineer, Pennsylvania Power & Light Company, Allentown, Pa.

OPENING FOR junior sales and service man in small organization handling power plant equipment. Diesel knowledge helpful. P-1918, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED—GRADUATE Electrical Engineer with experience in design, layout and maintaining electrical equipment and power distribution. Must be able to plan and direct the engineering of electrical work in plant with 2,300 volt, 5,000 KW generation. Middle Western location. P-2619 Power, 330 W. 42nd St., New York 18, N. Y.

PROMINENT MID-WESTERN glass co. will consider applicants with sound technical education or experience for position in research, development and combustion engineering. P-2116, Power, 520 N. Michigan Ave., Chicago 11, Ill.

EMPLOYMENT SERVICES

SALARIED POSITION $2,500-$25,000. This thoroughly organized confidential service of 37 years recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 109 Church Street, New Haven, Conn.

POSITIONS WANTED

STEAM POWER Plant Supervisor or results engineer—age 38; married; eighteen years experience all phases of hi-pressure steam plant operation testing and maintenance. PW-1793, Power, 520 N. Michigan Ave., Chicago 11, Ill.

GENERAL FOREMAN Electrical. Experienced in supervision operation, maintenance and construction of hydro-electric power plants and systems. Generation to 130,000 KW, transmission to 230,000 V. Metering, relaying, electric and hydraulic control, dispatching. PW-1780, Power, 68 Post St., San Francisco 4, Cal.

CHIEF ENGINEER—48 yrs.-24 yrs. experience. Has had complete charge of 4 steam generating plants. Broad knowledge both theoretical and practical of power problems, refrigeration, water filtration and treatment. Willing to travel or go abroad. PW-2634, Power, 520 N. Michigan Ave., Chicago 11, Ill.

POSITIONS WANTED

PLANT ENGINEER, Grad. Mechanical Engineer wants position in Industrial Plant, preferably one with power plant. 13 years experience—5 years supervisory industrial plant maintenance, construction and operation—8 years large utility power plant maintenance and operation. Age 38. Married, ASME. PW-2583, Power, 330 W. 42nd St., New York 18, N. Y.

FOR SALE

POWER PLANT and Franchise. FS-2599, Power, 520 N. Michigan Ave., Chicago 11, Ill.

MANUFACTURER'S REPRESENTATIVES

Electrical, Industrial and Construction Equipment and material lines desired.

Experienced Sales personnel with Electrical and Mechanical Engineering backgrounds. Merchandising and field construction experience.

We are covering Utilities, Industrial, Electrical Jobbers, dealers and contractors and State, County and Municipal Governments in Delaware, Maryland, District of Columbia, Virginia and North Carolina.

AMERICAN ENGINEERING EQUIPMENT CORPORATION
P. O. Box 186 — Alexandria, Virginia

CASH PAID
For Capital Stock or Assets of
INDUSTRIAL ENTERPRISE
• WANTED

By large financially powerful diversified organization wishing to add another enterprise to present holdings.

Existing Personnel Normally Retained

Box 1234, 1474 Bway, N. Y. 18, N. Y.

NOTICE . . .

Effective with the December, 1947 issue of POWER, the SEARCHLIGHT SECTION (Classified Advertising) Undisplayed rate will be $1.20 per line.

Position wanted—full or part-time salaried employment only—one half of the above rate, payable in advance.

Discount of 10% if full payment is received in advance for 4 consecutive insertions.

Classified Advertising Division
POWER

Wanted! Mechanical Engineer for important position

● To supervise all powerhouse operation activities at large Indiana plant. Forecast, schedule, and analyze output steam, water, heat, air; full charge of staff, keep plant at full efficiency. Fine working conditions, good salary and future. Five years' operating experience required. Give personal and experience details in application to:

NATIONAL RECRUITING DIVISION
RCA VICTOR CAMDEN, N. J.

A STANDARD OF QUALITY THAT IS NEVER LOWERED

Electrical Equipment

rebuilt and tested by our Electrical Engineers TO N. I. S. A. STANDARDS

MOTOR GENERATOR SETS

1—125 KW Crocker Wheeler 125 V, 1200 RPM. 2300 V., Squirrel Cage.
1—100 KW Elec Mach. 125 V., 1200 RPM. 4150 volt, synchronous.
1—100 KW General Electric, 230 v., 900 RPM. TS 4150 v. syn.
1—50 KW Ridgeway 1200 RPM. 550 Volt, Motor Sq. Cage, 220 volt.
1—5 KW General Electric, AC Gen. 1800 RPM. 120 volt, single phase, DC Motor, 230 volt.
4—100 KW General Electric, 60 volt, 1200 RPM. 125 HP Squirrel cage 220/440 volt.

ENGINE GENERATOR SETS

1—150 KVA General Electric, Ames Uniflow 220 volt, 3 phase, non-condensing.
1—62½ KVA Westinghouse 240 volt, 3 phase, Fairbanks non-condensing.
1—13 x 15 Uniflow Engines 150/300 RPM for Ice Compressors.
1—200/273 volt Gasoline Van Bierck 8 cyl. 1500 RPM.

TURBO GENERATOR SETS

1—300 KW General Electric ATB 240 Volt, 3 phase, condensing.
1—30 KW Allis Chalmers 3600 RPM. 125 volt, Terry Non-Condensing.

PLATING SETS

1½ KW G.E., 1800 RPM 5/6 volts, squirrel cage motor.
12 KW Hanson Van Winkle 24 volt with exciter, 1200 R.P.M. with squirrel cage motor.

TRANSFORMERS

1—300 KVA Pittsburgh 4000 volt, single phase 110/220 volt secondary.
1—1000 KVA General Electric Auto transformer, 3 phase, 4150 volt, 3 phase, 2406 volts.
3—150 KVA 3 phase, 4320 high tension primary, 125/217 secondary, General Electric.
1—100 KVA Westinghouse, 13200 volt, 250 volt, single phase.
3—75 KVA 440 to 220 primary, 120 to 240 secondary.
46—50 KVA Westinghouse, 13,800 primary, 120 volt secondary.
35—50 KVA G.E., 13,800 primary, 120 volt secondary.
5—50 KVA Westinghouse, 13,800 primary, 125 volt secondary.
5—50 Westinghouse 12,800 primary, 240/120 secondary.
10—27½ KVA General Electric brand new Air Cooled 440/220 220/110 single phase.
3—10 KVA Westinghouse Air Cooled, 450 volt, primary, 117 Volt secondary, single phase.

A. C. GENERATORS

500 KW General Electric .8 PF, 3600 RPM. ATB, 600 volts, DC exciter.
240 KW General Electric .8 PF, 600 RPM. ATB, 600 volts, DC exciter.
200 KVA Allis Chalmers, 3600 RPM. 240 volt, 2 phase, DC exciter.
200 KVA Westinghouse, 600 RPM. 240 volt, 3 phase, DC exciter.
200 KVA Allis Chalmers, 900 RPM. 240 volt, 3 phase, DC exciter.
180 KW Westinghouse, 514 RPM. .8 PF. 550 volt, 3 phase.
2—167 KVA General Electric, 1200 RPM. .6 PF. 450 volt, 3 phase.
165 KW Electric Machinery, 514 RPM. 240 volt, 3 phase.
120 KW General Electric, ATB, .8 PF. 720 RPM. 2300 volt, 3 phase.
100 KW General Electric, ATB, 600 RPM. 240 volt, 3 phase, DC exciter.
62½ KW Allis Chalmers, 3600 RPM. 220 volt, 3 phase, DC exciter.
35 KW Columbia Elect. .8 PF. 1200 RPM. 240 volt, 2 phase, DC exciter.
31.3 KVA American Customs, .8 PF. 1200 RPM. 120/208 volt, 3 phase, DC exciter.
12.5 KVA Westinghouse, .8 PF. 1200 RPM. 240 volt, 3 phase, DC exciter.

SYNCHRONOUS MOTORS

150 HP General Electric, T.S. 900 RPM. 4160 volt, 3 phase, DC exciter.
75 HP, 1200 RPM. General Electric, 440 volt, 3 ph., DC exciter.
70 HP Electric Machinery, 180 RPM. 2200 volt, 3 phase.
40 HP Westinghouse, 1800 RPM. 220 volt, 3 phase, DC exciter.
35 HP General Electric, 1200 RPM. 2200 volt, 3 phase, DC exciter.
20 HP Westinghouse, 1800 RPM. .8 PF. 220 volt, 3 phase.

MOTORS—3 ph. 60 cycle
SQUIRREL CAGE

1—750 HP General Electric, 750 RPM, 6600 volt, 3 phase, 25 cycle.
1—200 HP General Electric IK, 450 RPM, 2200 volt.
1—125 HP U. S., 1200 RPM. vertical hollow shaft, 220 volt, 3 phase, 60 cycle.
1—450 HP Ridgeway 900 RPM, 2200 volt, 3 phase.
1—75 HP Westinghouse, 1800 RPM, 2200 volt.
1—75 HP General Electric, Type KT, 1200 RPM, 440 volt.
1—60 HP Westinghouse, 900 RPM, Type CS, 220 volt.
3—40 HP General Electric, Type KT, 900 RPM. 220 volt, 3 phase.
1—35 HP General Electric, Type 1, 600 RPM, 350 volt, 3 phase.
2—10 HP Westinghouse gear 440 RPM. output 440 volt, 3 phase.

MOTORS—3 ph. 60 cycle
SLIP RING

1—450 HP General Electric, 425 RPM, ITC, 440 volt 25 cycle.
1—100 HP General Electric, 720 RPM, IM, 440 volt 25 cycle.
1—60 HP, General Electric, 600 RPM, MT, 220 volt.
1—50 HP, General Electric, Type MT, 600 RPM, 220 volt.
1—50 HP F & B, 1800 RPM. BV, 220 volt.
1—50 HP General Electric, 900 RPM. IM, 440 volt.
1—40 HP Cont. 1150 RPM. SA55, 220 volt.
1—40 HP General Electric, 1130 RPM. MT, 220 volt.
1—40 HP General Electric, 900 RPM. MT, 220 volt.
1—40 HP General Electric, 900 RPM. MTI, 2000 volt.

JLHCo

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

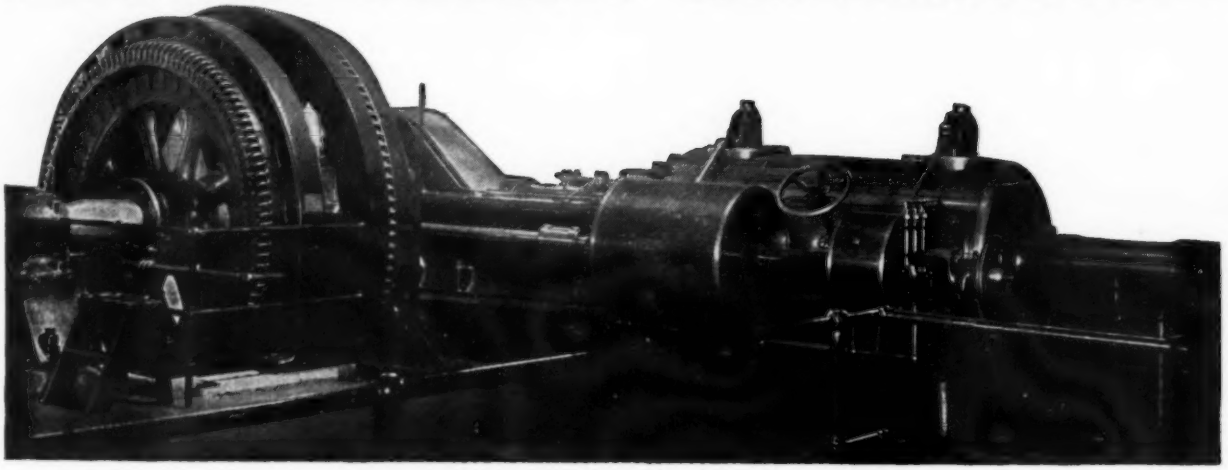
J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

POWER PLANT MACHINERY



750 KVA NORDBERG UNIFLOW ENGINE GENERATOR UNIT

600 KW 80% P.F. 750 KVA General Electric alternating current generator 3 phase 60 cycle 4000/2300/600/480/240 volts 150 RPM direct connected to Nordberg uniflow noncondensing engine, 150-200# steam pressure, 0-15# back pressure. This unit is in excellent condition, available for immediate delivery.

CONDENSING TURBO UNITS

3 phase 60 cycle

7500 KVA G. E. 2400 volts 250# steam
3750 KVA Wstgh. 4160 volts 200# steam
2500 KVA Allis 2400 volts 200# steam
1875 KVA G. E. 480 volts 225# steam
1563 KVA Allis 2400 volts 200# steam
1250 KVA G. E. 2400/600 volts 250# steam
750 KVA G. E. 2400 volts 200# steam
625 KVA Wstgh. 2400 volts 250# steam
625 KVA G. E. 480 volts 200# steam
375 KVA G. E. 480 volts 400# steam

NONCONDENSING TURBO UNITS

3 phase 60 cycle

2500 KVA G. E. 480 volts 150# steam 15# exhaust
1250 KVA Wstgh. 2400 volts 300# steam 10# exhaust
937 KVA Moore 2400 volts 175# steam 20# exhaust
750 KVA G. E. 480 volts 115# steam 5# exhaust
625 KVA Wstgh. 480 volts 300# steam 10# exhaust
375 KVA Terry 240 volts 200# steam 100# exhaust
375 KVA G. E. 240 volts 150# steam 10# exhaust
250 KVA G. E. 480 volts 200# steam 5# exhaust
187 KVA G. E. 480 volts 250# steam 15# exhaust
187 KVA Wstgh. 240 volts 125# steam 25# exhaust

EXTRACTION TURBO UNITS

3 phase 60 cycle

3750 KVA Wstgh. 2400 volts 150# steam, 10# extraction
2500 KVA G. E. 600 volts 225# steam, 20# extraction
1250 KVA Allis 480 volts 300# steam, 35# extraction
1250 KVA Elliott 480 volts 150# steam, 60# extraction
625 KVA Wstgh. 480 volts 250# steam, 25# extraction

UNIFLOW UNITS

3 phase 60 cycle

750 KVA Skinner, 2300 volts, 175# steam, 15# exhaust
625 KVA Skinner 2300 volts, 140# steam, 5# exhaust
375 KVA Skinner 2300 volts, 125# steam, 5# exhaust
312 KVA Skinner 480 volts, 165# steam, 5# exhaust
250 KVA Skinner 480 volts, 165# steam, 5# exhaust
250 KVA Skinner (vertical) 240 volts 150# steam, 5# exhaust
187 KVA Ames (vertical) 240 volts 150# steam, 5# exhaust

BOILERS

ASME Code

140,000 lbs/hr B & W 625 lbs. steam 750 deg. T. T., stoker
60,000 lbs/hr Springfield 225 lbs. steam 500 deg. T. T., pulverizer

DIESEL UNITS

3 phase 60 cycle

1000 KVA Busch-Sulzer 2400 v.
500 KVA McIntosh-Sey. 2400 v.
432 KVA Worthington 2400 v.
350 KVA Worthington 2400 v.
250 KVA General Motors 480 v.
250 KVA Fairbanks Morse 2400 v.
213 KVA Worthington 2400 v.
187 KVA Fairbanks Morse 2400 v.

MOTOR GENERATOR SETS

3 phase 60 cycle

1000 KW G. E. 600 v D. C., 6600/11400 v A. C.
300 KW G. E. 250 v D. C., 440 v A. C.
200 KW G. E. 250 v D. C., 440 v A. C.
200 KW C. W. 125 v D. C., 2300 A. C.
60 KW G. E. 125 v D. C., 440 v A. C.

ROTARY CONVERTERS

3 phase 60 cycle

3500 KW G. E. 225/285 v D. C., 13800 v A. C.
2000 KW Wstgh. 600 v D. C., 22000 v A. C.
2000 KW Allis 600 v D. C., 4150 v A. C.
1500 KW Wstgh. 600 v D. C., 4000 v A. C.
1000 KW G. E. 600 v D. C., 13200 v A. C.
500 KW Wstgh. 600 v D. C., 16500 v A. C.

RECTIFIERS

3 phase 60 cycle

3000 KW (2) G. E. 600 v D. C., 13800 v A. C.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone Main 9514 CLEVELAND 14, OHIO

BELYEA SAYS: "Our reputation is your protection!"

WHEN YOU BUY

RE-NU-BILT REBUILT—BY SPECIALISTS ELECTRICAL EQUIPMENT

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1000 K Whse. 600 V. D.C., to 1400 HP. 2300/4000 V. Syn. Motor.
1—1000 KW Al. Ch. 450 V. d.c. to 1250 Kva 2300 V. Syn. Motor.
1—600 KW G.E. 3 unit with 2-300 KW 250 V.
2—500 KW G.E. 600 V. D.C. to 710 H.P.—4400 V. Syn. Motor with exciter. Gens. d.c. to 850 HP. 2300 v.
1—500 KW G.E. 600 V. d.c. to 700 HP—13200.
1—400 KW G.E. 3 Unit with (2) 200 KW 125 V. d.c. to 600 HP—2300 v. Syn.
1—400 KW Whse. 250 V. d.c. to 600 HP—440 V. Syn. with exciter.
1—300 KW G.E. 250 V. D.C. to 360 KVA—440 V. Syn. Motor with exciter.
1—300 KW G.E. 550 V. d.c. to 435 HP—2300/4000 Syn. with exciter.
1—250 KW G.E. 275 V. d.c. to 350 Kva 2300/4000 Syn. with exciter.
1—200 KW G.E. 125 V. d.c. to 300 HP 440 V. Syn. with xciter.
1—150 KW Whse. 600 V. d.c. to 225 HP—2300 V.
1—100 KW GE 250 V. d.c. to 150 HP 440 V. Ind. Motor.
1—100 KW G.E. 125 V. D.C. to 150 H.P.—220 V. Ind. Motor.
4—90 KW G.E. 62½ V. D.C. to 135 H.P.—220/440 V. Ind. Motor with unit controls.
2—75 KW Cr. Wh. 250 V. D.C. to 125 H.P.—220/440 V. Ind. Motor.
1—75 KW G.E. 125 V. d.c. to 120 HP—4000/2300 V. Ind.
1—60 KW Cr. Wh. 250 V. D.C., to 100 HP. 220/440 V. Ind. Motor.
1—50 KW G.E. 125 V. D.C. to 75 H.P.—220 V. Ind. Motor.
2—48—KW G.E. 3 unit with (2) 24 KW, 60 V. gens. d.c. to 75 HP. 440 V. Ind.
1—35 KVA Whse. 240v., 3 ph., 60 cy. A.C. gen. with 35 HP.—230 V. d.c. motor.

FREQUENCY CHANGER SETS

1—1000 KW—GE—2 Unit—3 Brg. Consisting of—1400 HP—4400 V. 3 ph. 25 Cy. Motor and 1000 KW—2300 V.—8 ph. 58.3 cycle gen. with exciter (Gen. can be reconnected for 800 KW, 3 ph.)
1—840 KW—GE—2 unit with 2 exciters consisting of 1700 HP—2300 V, 3 ph. 25 cycle motor and 1200 KVA.—.7 pf. 2400 V. 3 ph. 60 cycle gen.

ROTARY CONVERTERS

60 cycle

KW	Make	Speed	Volts	Volts
1—1500	Whse.	720	600	2300
1—1000	G.E.	900	600	13200
1—1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 750	Whse.	720	250	6600
1— 500	Whse.	1200	600	13200

TURBO-GENERATOR SETS

1—3000 KW Whse. 3750 Kva. 2300 V. 3 ph. 60 cy. with Parsons 200 lb. Cond. turbine.
1—3000 KW G.E. 3759 Kva. 2300 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.
1—2500 KW G.E. 3125 Kva. 600 V. 3 ph. 60 cy. with 200 lb.; 15 lb. auto extraction turbine.

SPECIAL

1—2500 KVA G.E. Auto Extraction, 225 lbs., 500" F.T.T.—20 lbs. extraction. Surface condenser, 600 volt, 3 phase, 60 cycle. Panel and all auxiliaries.

1—2000 KW G.E. 6600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.
1—1500 KW G.E. 1875 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.

SPECIAL

2 New 2500 KW Worthington-Moore condensing extraction—400 lb. psi., 135 lb. extraction with 3125 KVA, 2400/4150 volt 3 ph. 60 cy. generator and direct connected exciter.

2—1250 KW G.E. 1560 Kva. 2300 V. 3 ph. 60 cy. with G.E. 175/200 lb. Condensing turbine.
1—1250 KW G.E. 600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.
1—1250 KW Al. Ch. 1560 Kva. 2300 V. 3 ph. 60 cy. with 200 lb. Condensing turbine.
1—1000 KW G.E. 1250 Kva.—2300/4100 V. 3 ph. 60 cy. with G.E. 135/175 lb. Cond. turbine.
1—500 KW G.E. 625 Kva.—240/480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.
1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E. 80/100 lb. Cond. turbine.
1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb., 10 lb. back pressure turbine.
1—300 KW Al. Ch. 120/240 V. d.c. geared to Whse. 440 lb. Cond. turbine.
1—200 KW G.E. 600 V. 3 ph. 60 cy. with 150 lb. non-cond. turbine and exciter.
1—125 Kva. G.E. 2300 V. 3 ph. 60 cy. with 125/200 lb. Non-Cond. turbine.
4—60 KW Whse., Condensing, 200 lbs. with 60 KW, 120 V. D.C. Gen.

SPECIAL

500 HP — GE — KF-559 — 3575 RPM — 2300 Volt Sq. Cy. Motor connected to Byron Jackson 325 GPM—10 stage, 3500 ft. head pump.

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
1—1875	G.E.	ATI	13800	600
1— 600	G.E.	TS	2300	900
1— 600	G.E.	ATI	600	900
2— 350	G.E.	TS	2200	150

SLIP RING

1—1000	Whse.	CW	2300	700
1— 900	G.E.	IM	2300	880
1— 750	Whse.	CW	2200	327
1— 450	Cr. Wh.	SR-31	2300	392
1— 450	G.E.	I	440	506
1— 350	G.E.	MT-442Y	2200/4000	253
1— 300	Whse.	CW	440	1750
1— 250	Whse.	CW	2200	500
3— 200	G.E.	IM	440/550	435
1— 250	G.E.	MT-424Y	4000	257
1— 100	Al. Ch.	ANY	220	435

SQUIRREL CAGE

1—800	Whse.	CS-1221A	2200	706
1—700	G.E.	ICT	2300	705
1—600/450	Whse.	CS	2300	585/439
1—250	G.E.	IK	440	600
1—200	G.E.	IK	550	865
1—150/70	G.E.	IK	440	1170/870
1—100	G.E.	IK (Vert.)	2300	450
1—100	G.E.	IK	2200	600
1—100	G.E.	IK	220	865

SPECIAL
MERCURY ARC RECTIFIERS

1—750 KW—GE—Type RHW—6 Anode 575 V. D.C. Form C with 2300 V. 60 cycle transformer and switching equipment.
1—500 KW—GE — Type RHW — 6 Anode 575 V. D.C. Form B with 2300 V. 60 cycle transformer and switching equipment.

D. C. MOTORS

HP	Make	Type	Volts	Speed
2—800/1000	Whse.		450	600/720
1—800	G.E.	MPC	600	600
1—765	G.E.	MPC	500	1045/1350
1—700	G.E.	MCF	600	150/525
1—650	G.E.	MPC	250	115/145
1—375	G.E.	MPC	230	450/900
1—350	Whse.		230	300/900
2—350	G.E.	MPC	250	450
1—345	Whse.	MQ	250	300/900
1—300	G.E.	DMC	230	400/600
1—300	G.E.	MPC	230	275/550
1—250	G.E.	MPC	230	400/500
1—230	Al. Ch.		230	700
1—150	G.E.	MPC	230	250/450
1—150	Cr. Wh.	CMC-65H	230	1150
1—130	Cr. Wh.	CMC-51H	550	1200
2—125	G.E.	CO-1832	230	625
1—125	G.E.	CD-125	230	1150
4—101	Whse.	SK	230	485/950

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BELYEA COMPANY, INC.

39th YEAR

Main Office and Shop
43 HOWELL ST., JERSEY CITY 6, N. J.
Phone—Journal Square 2-3334
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SINCE 1910—EQUIPMENT THAT PERFORMS!

1 YEAR GUARANTEE

125 V.-250-550 V D. C. GENERATORS

(Motor Driven and Belted)

KW	Make	Voltage	Ampere	Speed
500	Al.-Ch.	250	2000	900
250	G.E.	125	2000	690
200	G.E.	125V	1600	900
200	Cr. Wh.	550	363	900
175	Cr. Wh.	250	700	1200
150	G.E.	250	600	580
150	G.E.	125	1200	1200
150	West.	250	600	1150
125	G.E.	250	500	850
125	Ideal	250	500	1500
100	G.E.	125	800	730
75	West.	250	300	870
40	G.E.	250	160	1150
40	Century	125	320	1450
40	West.	250/125	160	1500
40	G.E.	250	160	800
25	Allen	110	320	500
20	Delco	125	160	1200
20	Cel. (3)	125	160	1750
15	G.E.	125	120	1750
15	West.	230	60	1450
15	G.E.	125	120	1150
15	G.E.	125	120	850
10	Rogers (2)	125	80	1450
10	El. Dy.	125	80	600
8	G.E. (2)	125	64	1800
7½	G.E.	125	60	1800
5	G.E. (2)	125	40	1740
5	Rel.	250	20	1725

80—Additional generators—125 V. up to 200 V. generators in stock.

LOW VOLTAGE D. C. GENERATORS

KW	Make	Voltage	Ampere	Speed
105	West.	75	1500	1150
75	G.E.	75	1000	1145
22½	West.	75	300	720
90	Century	60	1600	1150
1½	G.E.	60	19	1800
3	Hertner	60	60	1730
40	G.E.	50	800	1160
3½	G.E.	42	205	1800
5	Diehl	40	125	1750
33	G.B.	33	1000	850
39	G.E.	32	1200	1750
6½	G.E.	32	205	1800
3	G.E.	30	100	1200
6	Star (2)	25	250	1800
5	Star	25	200	1750
15	Rel.	24	625	1450
4	Star	20	200	1800
1	West.	16	60	1750
11	Star	15	750	1200
1	Cont. (2)	15	67	1750
4½	Star	15	300	1800
30	Columbia	8-16	5000/2500	720
12	H.V.W.	12/24	1000/500	900
12	H.V.W.	6/12	2000/1000	720
6	Columbia	6/12	1000/500	1200

300—Additional low voltage generators in stock.

NEW MOTORS IN STOCK

1 HP. to 30 HP.
3 ph. 60 cy. 220/440 V.
1200 & 1800 RPM
Ball Bearing
Nema Frames

230 V. D. C. MOTORS

Qu	H.P.	Make	Type	Speed
1	125	G.E.	RC	1750
1	100	West.	SK-160	625
1	100	Rel.		475/635
1	100	Rel.	1050T	400/1200
1	75	West.	SK	475
1	75	Cr. Wh.	New	480/670
1	75	Cr. Wh.	CMC	375/750
3	60	West.	SK-160	650
1	60	G.E.	C	480/1100
1	45	Diehl	K-10	850
2	40	G.E.	DLC-25	1050
8	40	G.E.	CD1441	250/1500
1	40	Cr. Wh.	CCM	700
1	35	G.E.	RLC-204	440/800
1	35	G.E.	RF	500/1500
1	35	West.	SK-160	400
1	30	G.E.	RC-32	1100
1	30	West.	S-6	1025
1	30	West.	SA	975
2	30	West.	SA	500/1500
2	25	G.E.	RC-31	1150
1	25	West.	SK	1100
1	25	Rel.	92T	1150
1	25	West.	SK	900
4	25	G.E.	RF-1	500/1500
1	25	West.	SK	500/1500
1	25	G.E.	RF-11	500/1500
2	25	G.E.	RF-14	300/1200
1	25	G.E.	RF-14	300/900
1	25	West.	SA	325/975
1	20	G.E.	CD-85	1150
1	20	G.B.	RC-11	1150
1	20	West.	SK-103	1200
1	20	West.	S-6	975
2	20	West.	SK-83	850
1	20	G.E.	RC	800
1	20	Al. Ch.	Series	625
1	20	West.	HY-6	700
1	20	G.E.	RF-11	500/1500
10	20	G.E.	RF-12	400/1200
2	20	Star	SHB-20	29.2
2	10/25	Cr. Wh.	35-JA	400/1200
1	15	Roch.		3450
4	15	Star	SQ-1520	1290
1	15	G.E.	RC	1200
1	15	West.	SK-80L	1100
1	15	G.E.	RC-29	1150
1	15	G.E.	RC-10	1150
1	15	G.E.	CDC-85	900
1	15	West.	SK	850
1	15	G.E.	CDE-83	850

230 V. D.C. MOTORS (Cont.)

Qu	H.P.	Make	Type	Speed
2	15	G.E.	RC-30	850
1	15	West.	SK	675, 1350
1	15	El. Dy.	58	600/1200
1	15	G.E.	CQ	600, 1500
1	15	G.E.	LC	675, 1150
2	15	West.	SK-100L	600/1500
1	15	G.E.	RF-11	400-1600
1	15	West.	SK	250, 1100
1	15	Diehl		200, 247
1	10	G.E.	CD-75	1150
1	10	G.E.	RC	1100
1	10	Triumph	TR-10S	860
1	10	G.E.	RC-29	850
1	10	Diehl	LS-14	750
1	10	West.	SK-71	700
1	10	Cr. Wh.	CSM	675
1	10	West.	SK	600/1200
2	10	G.E.	RLC	500/1500
1	10	G.E.	RF-10	400/1600
1	10	West.	SA	400/1200
1	10	G.E.	RF-10	400/1200
1	10	Rel.	131T	250/1000
2	10	West.	Gr. Hd.	2/10
1	7½	Sturt		3600
1	7½	L A	284	1750
1	7½	El Dy.	28	1750
1	7½	G E	RC	1700
1	7½	West	SK	1800
2	7½	Cr Wh	CCM	1425
3	7½	West	SK	1100
1	7½	G.E.	RC	1100
1	7½	G.E.	CO 1804	1200/3200
2	7½	West.	SK 50	975
1	7½	G.E.	RC	900
1	7½	Cr. Wh.	CCM	875
2	7½	G.E.	RC	850
1	7½	West	Sm 0	850
1	8½	West.	SK 30	825
1	7½	G.E.	RF 10	600/1500
1	7½	West	SK 90	650/1300
1	7½	El. Dy.	38	550/1650
2	7½	L.A.	BW-15	525/1150
1	7½	Roth	RS-107	450/900
1	7½	West.	SK-70	400/1600
1	7½	West.	SA	400/1600
1	7½	G.E.	RLC	400/1600
1	7½	Al. Ch.		350/1050
1	5	Star	SB-5	1500
1	5	Rel.	T-254	1750
2	5	G.E.	RC	1700
1	5	G.E.	CDV	1750
1	5	G.E.	CVC	1650
1	5	G.E.	CD-65	1150
1	5	Rel.	32T	1150
6	5	G.E.	RC-27A	1150
2	5	West.	SK-43	1150
1	5	G.E.	B-284	1150
1	5	West.	SC-3	870/1750
1	5	Rel.	23T	850/1700
1	5	Al. Ch.	E-75	50
1	5	G.E.	RC	600
1	5	Cont.	D-49	600/1800
1	5	Star	SB-10	600/1200
1	5	El. Dy.	3-8	550/1650
2	5	West.	SK-60	500/1500
1	5	Cr. Wh.	CM	400
2	3	G.E.	BD-235	3600

800—Smaller D.C. motors in stock including fractional.

110 V. D.C. MOTORS

Qu	H.P.	Make	Type	Speed
1	25	Star	15-L	2400
1	25	G.E.	CDM-95	1000
1	20	G.E.	CD-83	1750
1	16	Cr. Wh.	CMC-L	1750
1	15	West.		1150
1	15	El. Dy.	7½-8	615/1230
1	15	West.	S	560
4	10	Lincoln		3500
1	10	L. A.		3500
1	10	Al. Ch.	EBC-75	2175
1	10	G.E.	CD-73	1750
1	10	West.	SK-70L	850
1	10	Cont.		825
1	10	Rel.		400/1600
1	10	Diehl.		230

600—Smaller size 110 V.D.C. motors including fractional horsepower motors also in stock.

NEW

Direct Current Manual and Automatic Starters

CUTLER - HAMMER
GENERAL ELECTRIC
WARD - LEONARD

230 Volts

164—1 H.P. Manual
24—1 H.P. Automatic
197—1½ H.P. Manual
206—2 H.P. Manual
119—2 H.P. Automatic
270—3 H.P. Manual
95—3 H.P. Automatic
343—5 H.P. Automatic
9—10 H.P. Automatic
3—20 P.H. Automatc
19—60 H.P. Automatic
50—75 H.P. Automatic

115 Volts

19—1 H.P. Manual
8—1½ H.P. Manual
8—2 H.P. Manual
23—3 H.P. Manual
398—5 H.P. Automatic
1—60 H.P. Automatic

You must BUY!
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these starters.

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GLOW

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
350	514	440	GE-I
250	600	2300	Triumph
223	3600	4150	GE-FR
200	600	2300	C-W
150	600	220	GE-I
150	600	2300	GE
150	450	220	GE-I
125	3600	220	A-C-AN
100	514	220	A-C
100	450	220	A-C
75	720	2300	Wagner
75	600	440	GE-I
75	360	220	GE-I
60	3600	2300	GE-KT
50	720	2300	Wtg.-CS
40	900	2300	Wtg.-CS
35	600	220	Triumph
25*	1200	220/440	Wtg.
25	1200	2300	GE-I
25	900	220	GE-FTR
25	900	220	Wtg.-CS
25	720	220	Wagner
25	600	440	GE-I
20*	1800	220/440	F-Morse
20*	1200	2300	F-Morse
20	900	440	Wtg.-CCL
20	900	2300	Wtg.-CS

ENCLOSED SQUIRREL CAGE

HP	RPM	Volts	Make
125*	1200	440	GE-TEFC-BB
10*	1800	dual	Master-TEFC-BB
10	1800	440	GE-TEFC-BB
5*	1800	dual	Master-TEFC-BB
5	1800	220	Wagner TE-BB
5*	1200	dual	GE-TEFC-BB
3	3600	440	Wtg.-TE-BB
3	1800	dual	Delco-TEFC-BB
3	1200	dual	Rel.-TEFC-BB
2	1200	220	GE-TE-BB
2	900	220	Wagner-TE-BB
1½	1800	dual	L. Al.-TE-BB
1½	1200	dual	Ref--TEBB
1	3600	220	Haskins-TEFC
1	1800	dual	Master-TEFC-BB
1*	1800	dual	Delco-TE-BB
1*	1200	dual	Rel.-TE-BB
¾	3600	440	Delco-TE
¾	1800	dual	Wesche-TE-BB
½	3600	220	Ohio-TE-BB
½	1800	440	Wtg.-TE-BB
½*	1800	dus	Delco-TE-BB
½	1200	220	Cr. Wh.-TE
¼	3600	440	GE-TE
¼	1800	220	Delco-TE-BB
⅓	1800	440	Delco-TE-BB

* New Motor

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg.
400	1200	2300	Al. Ch.
400	900	440	GE-IM
375	1800	2300	Al. Ch.
235	1800	220	GE-I
250	300	2300	Al. Ch.
200	514	440	Triumph-C
75	720	2300	Wagner-BR
75	450	440	Wtg.-CW
75	360	220	GE-I-M
60	1800	dual	Al. Ch.
60	900	2300	Burke
60	900	220	Wesche
50	900	2300	Ridgeway
50	900	440	Wagner
50	720	440	Al. Ch.
40	1200	220	Wtg.-CW
40	900	2300	Al. Ch.
40	900	220	Wtg.-HF
40	720	2300	Wtg.-HF
40	720	220	Al. Ch-ANY
40	600	2300	Al. Ch-ARY
40	600	220	Al. Ch.-ANY
40	450	220	Triumph-C
35	900	2300	Ridgeway
35	720	220	GE-I
30	1800	2300	Wtg.-CW
30	1200	440	GE-I
30	1200	2300	Lincoln
30	900	220	GE-MT
30	900	2300	Ridgeway
30	720	220	GE-I
30	600	2300	Al. Ch.-ARY
30	600	220	F. Morse-BV
25	1200	2300	Al. Ch.-ANY
25	900	220	GE-MT
25	720	dual	Watson-KH
25	600	220	Watson-KH
20	1800	440	Al. Ch.
20	900	2300	GE-I

VERTICAL MOTORS

HP	RPM	Volts	Make
200	1200	440	Al. Ch.-SR
150	1200	2300	GE-SR
150	1200	440	GE-Cage
125	1200	2300	Al. Ch.-Cage
100	1200	440	GE-Cage
75	1200	2200	GE-Cage
75	514	440	GE-Cage
75	360	220	Ideal-Cage
60	1800	230 D.C.	GE
60	1200	440	Al. Ch.-Cage
50	1800	440	GE-Cage
50	1200	2200	Wtg.-Cage
50	600	440	Al. Ch.-Cage
40	1800	220	GE-Cage
40	1700	230 D.C.	GE
40	1200	440	Wtg.-SR
40	1200	220	GE-Cage
40	950	230 D.C.	Wtg.
35	1200	440	GE-Cage
35	1200	2300	Al. Ch.-Cage
35	450	440	GE-Cage
30	1200	dual	Wtg.-Cage
25*	1550	230 D.C.	GE
25	1200	2200	GE-Cage
25	850	230 D.C.	Wtg.
20	1200	440	Al. Ch.-Cage

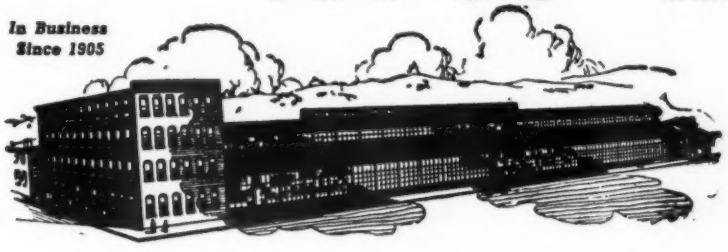
VERTICAL MOTORS—Cont'd

HP	RPM	Volts	Make
20	800	230 D.C.	GE
15*	1800	440	Al. Ch.-Cage
15	1750	110 D.C.	Wtg.
15	1150	230 D.C.	GE
15	600	440	Al. Ch.-Cage
12½	900	220	L. Al.-Cage
10	3400	230 D.C.	Wtg.
10	900	220	Wtg.-Cage
7½	1800	500 D.C.	Peerless
7½	900	440	GE-Cage
7½	700	230 D.C.	GE-Cage
6	850	110 D.C.	Rel.
5	1400	230 D.C.	R. & M.
5	600	440	GE-Cage
4	1650	110 D.C.	Watson
3	1700	230 D.C.	Watson
3	1200	dual	Wtg.-Cage
3	900	440	Wtg.-Cage
3	600	dual	Wtg.-Cage
2	1800	230 D.C.	GE
2	1800	220	L. Al.-Cage
2	1150	230 D.C.	Wtg.
2	900	220	GE-Cage
1	1200	220	GE-Cage

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
1200	900	440	GE
600	720	2300	Al. Ch.
500	1800	2300	GE
250	720	440	GE
250	225	2200	GE
250	225	440	GE
200	720	2300	GE
200	225	2200	Wtg.
175	225	208	GE
160	600	440	GE
160	164	440	GE
125	150	440	GE
120	225	220	E-M
115	164	208	GE
60	360	2200	GE
50	360	440	GE
30	900	440	Wagner
30	720	440	GE
30	600	550	GE
30	450	dual	Wtg.
30	360	550	GE
30	327	220	E-M
25	1800	220	Wagner
25	450	220	E-M
25	300	220	Ideal
20	900	220	Wtg.
20	600	220	E-M
15	1800	220	Wagner
10	1800	220	Wagner
10	1200	220	Wagner
7½	1200	440	Wagner

In Business Since 1905



TRANSFORMERS

General Electric Spirakore Transformers, 167 KVA, 2400/4160Y volt primary, 120/240 volt secondary, 1 phase, 60 cycle, oil cooled, outdoor type. Alternative same except secondary 240 or 480 volt.

DIRECT CURRENT GENERATORS

KW	Volts	RPM	Manufacturer	Description
400	120/240	300	Westinghouse	Compound, Interpole Pedestal Bearings
200	250	375	Jantz & Leist	Compound Wound, Pedestal Bearings
175	250	450	Westinghouse	Compound Wound, Pedestal Bearings
80	125	500	Jantz & Leist	Compound Wound, Double Shaft Extension
80	125	400	Jantz & Leist	Compound Wound, Double Shaft Extension
30	250	300	Triumph	Compound Wound
22½	250	765	Westinghouse	Compound Wound

MOTOR GENERATOR SETS

KW	Volts	Generator Mfgr.	A. C. Motor
500	600	General Electric	710 HP, 1.P.F., 720 RPM, 13200/6600 Volts, General Electric, Synchronous
*300	250	General Electric	450 HP, 1200 RPM, General Electric, Synchronous
200	230/250	Crocker-Wheeler	300 HP, 1.P.F., 600 RPM, 2300 Volt, Allis-Chalmers, Synchronous
200	125	General Electric	300 HP, 900 RPM, General Electric, Synchronous
50	120/125	Burke	95 HP, 1200 RPM, Burke, Synchronous
*50	115/230	Westinghouse	75 HP, 1800 RPM, Westinghouse, Induction
40	250	Reliance	60 HP, 1800 RPM Century, Induction
25	125	General Electric	35 HP, 1200 RPM, General Electric, Induction

* These Motor Generator Sets are unused.

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC HOISTS
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

ELECTRIC CO

933-943 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

REMEMBER

U. E. M.

For the Finest *in* POWER PLANT MACHINERY

Available Immediate Delivery

TURBINE-GENERATOR UNITS
3 phase, 60 cycle

3750 KVA G.E. 250 lbs. pressure, 4160 volts, complete surface condenser.
2500 KVA G.E. Automatic Bleeder Condensing, 225 lbs. pressure, 25 lbs. extraction, 600 volt complete condenser and panel.
2500 KVA Westinghouse condensing, 180 lbs. pressure, 2300 volts, 3600 RPM complete surface condenser, exciter.
1250 KVA G.E. condensing, 200 lbs. pressure, 2300 volt, 3600 RPM complete exciter, condenser, panel.
625 KVA G.E. condensing, 200 lbs. pressure, 2300 volts, 3600 RPM complete exciter, condenser, switchboard.
625 KVA G.E. non-condensing 150 lbs. pressure, 15 lbs. back, 2300 volts, 3600 RPM complete exciter, panel.
625 KVA Westinghouse automatic bleeder condensing, 250 lbs. pressure, 20 lbs. gauge back, 480 volts, 3600 RPM complete condenser and panel.
375 KVA G.E. condensing, 125 lbs. pressure, 2300 volt, 3600 RPM complete surface condenser and panel.
125 KVA Westinghouse non-condensing, 175 to 200 lbs. pressure, 0-10 lbs. back, 240 volts with exciter, panel.
125 KVA G.E. non-condensing, 175 to 200 lbs. pressure, 10 lbs. gauge back, 2300 volts, 3600 RPM complete.
100 KVA Westinghouse non-condensing, 125 to 150 lbs. pressure, 10 lbs. gauge back 2400/600 volts, 3600 RPM.

ENGINE-GENERATOR UNITS
ALTERNATING CURRENT—3 phase, 60 cycle

750 KVA G.E. 2300 volts 150 RPM generator direct connected 28"x32" Chuse Unaflow engine.
500 KVA Westinghouse, 460 volts, 164 RPM generator direct connected to 26"x28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pressure, 0 to 10 lbs. gauge back.
375 KVA Allis 240 volt, 200 RPM Generator direct connected to a Nordberg horizontal Unaflow non-condensing engine, 150 to 200 lbs. pressure, 5 to 20 lbs. gauge back.
312 KVA G.E. 480 volts, 180 RPM generator direct connected to 24"x20" Skinner Universal Unaflow engine, 175 to 200 lbs.
225 KVA E.M. 2300 volts, 200 RPM generator direct connected to 19"x24" Chuse Unaflow poppet valve engine.
200 KVA Crocker-Wheeler, 240 volts, 400 RPM generator direct connected to Ames vertical Unaflow engine, 110 to 125 lbs.
180 KVA G.E. 240/440 or 550 volts, 200 RPM generator direct connected to 18"x21" Chuse non-releasing Corliss engine, 125 to 140 lbs. presure.
156 KVA, E. M. 480 volts, 400 RPM Generator direct connected to Ames Vertical Unaflow Engine.

ENGINE-GENERATOR UNITS
DIRECT CURRENT

500 KW Crocker-Wheeler 250 volts, 150 RPM generator direct connected Ames Unaflow non-condensing engine—complete.
325 KW, 35°, 400 KW Maximum, Crocker Wheeler 125 volt, 300 RPM Generator direct connected to Skinner Vertical Unaflow Engine.
200 KW Burke 3-wire, 250 volt, 360 RPM generator direct connected Ames 4 cylinder vertical Unaflow non-condensing engine, 150 lbs. pressure complete switchboard.
75 KW Allis Chalmers-Terry, 125 volts, 2400 RPM 150 lbs. pressure non-condensing turbine generator unit.
35 KW General Electric, 125 volts, 3600 RPM non-condensing turbine-generator unit.
15 KW Crocker-Wheeler, 125 volts, 410 RPM generator direct connected to an American Blower vertical engine.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers 550/600 volts, 300 RPM direct current generator direct connected 2190 HP, 3 phase, 60 cycle, 4000/6600 volts synchronous motor.
62½ KVA G.E. 3 phase, 60 cycle, 2300 volts, 1200 RPM alternator direct connected 75 HP, 115 volts direct current motor.
50 KW Westinghouse, 125 volt, 1200 RPM direct current generator direct connected 75 HP, 3 phase, 60 cycle, 2300 volt induction motor.

SPECIAL OFFERINGS

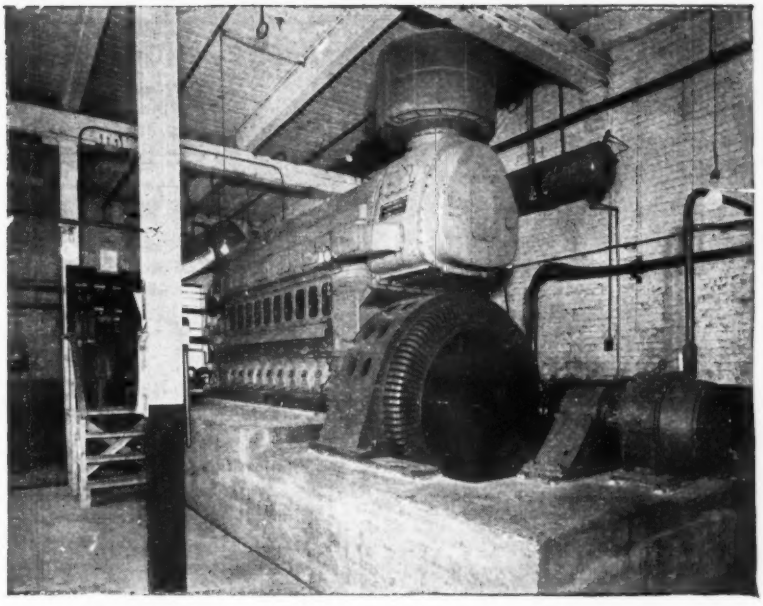
5425 GPM Worthington 70' head, 1800 RPM centrifugal pump direct connected 125 HP G.E. 3 phase, 60 cycle, 2200 volt slip ring motor.
1—Allis Chalmers jet condenser suitable for 2000 KW team turbine-generator unit.
1200 KVA General Electric, 3 phase, 60 cycle, 2400 volts alternating current generator direct connected to 1700 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM motor.
MANISTEE ROTARY JET CONDENSER 7000 lbs. steam per hour, 28" vacuum direct connected to a 25 HP, 3 phase, 60 cycle, 220 volt, 900 RPM G.E. motor.
10 TON CAPACITY BROWN HAND OPERATED TRAVELING CRANE with 31'0" span including 150' of I-beams.
500 KVA Westinghouse 3 phase, 60 cycle, 600 volts, 514 RPM belted generator.
10,000 Sq. Ft. 3 Pass Alberger Surface Condenser.
4,500 Sq. Ft. C. H. Wheeler Surface Condenser.
1,250 Sq. Ft. Elliott Surface Condenser.
250 to 1000 H.P. Water Tube Boilers, various sizes.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND 14 OHIO

WIRE OR PHONE
LONG DISTANCE 422

DIESEL GENERATOR UNITS
FOR MUNICIPAL, INDUSTRIAL OR UTILITY INSTALLATIONS



AN AGSCO 1000 KW UNIT AT IMPERIAL PAPER AND COLOR CORP.

DIESEL GENERATORS

A.C. 50 AND 60 CYCLE

	KVA	Make	HP	Model	RPM	Year
2	1875	Fairbanks-Morse	2000	33E16	300	1939
1	1250	Nelseco	1500	6M-63	300	1931
4	1250	Fairbanks-Morse	1700	38D8-1/8	720	1944
12	1250	General Motors	1600	16-278-A	720	1944
3	1000	Fairbanks-Morse	1250	38D1/8	600	1944
5	900	General Motors	1200	12-567	720	1944
1	625	Superior	750	OS	327	1938
2	375	Baldwin	450	VO	400	New
1	312	Enterprise	450	DSG-6	450	New
1	300	Fairbanks-Morse	360	YVA	257	1928
4	250	General Motors	300	8-268-A	900	New
1	94	Buckeye	112	E	400	193

INQUIRE FOR OTHER OFFERINGS

Write for Bulletins

DIESEL ENGINES

AG SCHOONMAKER CO INC.

50 CHURCH STREET NEW YORK 7, NEW YORK

Cable Address: AGSCOMACH PHONE: Digby 9-4350

Business Est. 1898

DIESEL POWER

AVAILABLE FOR IMMEDIATE SHIPMENT

UNIFLOW ENG. GEN. SET

1—300 kw Chuse vertical Uniflow engine generator set 6 cyl. 10 x 12 150# pressure O# B.P. 450 RPM direct connected to 300 kw G.E. Alternator 3-60-2300 v. with D.C. exciter 125 v. Excellent condition. Rebuilt 1945. Reasonably priced for quick sale.

SKINNER UNIFLOW SET

1—300 KVA Skinner Uniflow Engine Generator Set 150# ISP 0-5# BP direct connected to Burke Alternator 3-60-480 v. 200 RPM with Exciter and Control Panel.

TURBINE

1—710 H.P. Terry Turbine, type GF, 3531 RPM, complete with reduction gear to 1000 RPM. 145# pressure, 0.60# B.P.

AIR COMPRESSORS

1—Chicago Pneumatic Air Compressor, air cooled, 2 stage, 277 CFM displacement at 125 PSI with Receiver V-belted to 50 HP General Electric Motor 3-60-220-440 volt with control.

1—Ingersoll-Rand Compressor Type 40, 7" & 6¼" x 5" delivering 156 CFM at 100# with 40 HP Gen. Elec. TEFC motor, 3-60-220-440 volt, 900 RPM, Receiver and Control.

DIESEL ENGINES

1—150 H.P. Hercules 6 cyl., model DWXDS, 4¼ x 4¾.

3—68 H.P. Buda 6 cyl., model 6LD 468, size 4¼ x 5½.

AIR RECEIVERS

1—5' diam. x 14', Vertical.

1—6'2" diam. x 20'6", Vertical.

PUMPS

2—500 RPM, 360' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.

1—4500 GPM, 135' head, LeCourtney Centrifugal Pump, 1800 RPM.

2—520 GPM, 50' head, DeLaval Centrifugal Pump, 1150 RPM.

5—Worthington, 2⅜" x 18" Horizontal Duplex Double Acting, cap. 133 GPM, 3500# W.P.

CARRIER AIR CONDITIONING UNIT

1—30 ton Carrier Air Conditioning Unit consisting of two—2 cylinder Compressors and two—15 HP Motors mounted on common base; with Kathabar Unit complete with all accessories, starters and instruments. Electrical characteristics 3-60-220-440. New 1942. Has been in use one season.

FLANGED GATE VALVES

Stainless Steel. Sizes 1" to 6".
Iron Body. Sizes 2" to 14".
Cast Steel. Sizes 2½" to 12".

NEW HOISTS

40—Yale & Towne 2 ton Chain Hoists, 20' lift. BRAND NEW in Original Packing.

MOTORS

1—200 H.P. G.E. Synchronous Motor 3/60/4150, 600 RPM with starting panel, V-Belted exciter. New 1943.

1—125 H.P. West. Squirrel Cage, 3-60-2200 v., 1800 RPM and Starter.

1—20 H.P. General Electric Induction Motor, 3-60-220 v. 1160 RPM.

3—Vertical Gear Head Motors, Crocker Wheeler TEFC 10 H.P., 220°440 Volt, 60 cycle, 3 phase, 1745 RPM. Philadelphia Gear, output 425 RPM.

TRANSFORMERS

1—7½ KVA G. E., 460/230-115 v.
1—10 KVA G.E., 2400-4160/240-480 v.
3—20 KVA West. 450-117 v. New.
6—25 KVA West., 450-117 v. New.
3—37½ KVA G. E., 4600/2300 v.
1—100 KVA West., type S, 4370-4160-3950/208-120 v. 3 Ph.
1—500 KVA West., type SL, 4160/480 v.

300 AND 400 AMPERE ELECTRIC MOTOR DRIVEN ARC WELDERS

Lincoln—Hobart—General Electric
Reconditioned—Guaranteed—New 1943

MISCELLANEOUS

1—3600 sq. ft. C. H. Wheeler Surface Condenser.
7—Buffalo Steel Plate Blowers, 40", type R, with Everdur Blades.

Heat and Power Co., inc.

70 PINE STREET | WHITEHALL 3-2172 | NEW YORK 5, N. Y.

. . . always a wide selection . . . always unusual values

Listed below a few of the motors available in a hurry from Wente

SQUIRREL CAGE

3 Phase, 60 Cycle, 200/440 Volt

(Other voltage as noted)

Qu	HP	Make	Type	Speed
1	250	G.E.	KF Vert.	3600
1	150	Al. Ch.		1750
1	125	Cr. Wh.	126Q	430
1	120	G.E.	FT	3600
2	50	R.&M.	L	1200
1	50	Al. Ch.	AN	900
1	50	G.E.	I 2200 Volt	960
1	50	G.E.	I	720
1	50	West.	MS 25 Cycle	720
1	50	Wagner	BM	495
	50	Al. Ch.		490
2	35	Al. Ch.	2 Phase	900
1	35	Al. Ch.		900
1	35	G.E.	I 25 Cycle	730
1	30/30	West.	CS TEFCBB 1800/900	
1	30	F. M.	QZK Open BB	1200
1	30	Cr. Wh.		900
2	30	Al. Ch.	AN 2 Phase	900
1	30	Century	AS	720
1	25	Howell		1200
1	25	F. M.	QZK B.B. New	1200
1	25	Wagner	BP	1200
1	25	Burke	EM3	900
1	25	Lincoln		900
1	25	Al. Ch.	AN	720
1	25	G.E.	M10	720
1	25	West.	MS 25 Cycle	600
2	20	U. S.	SC SPBB	1800
2	20	F. M.	QZK B. V. New	1800
1	20	West.	CS	1800
1	20	Howell	N Vert. B.B. New	1200
1	20	F. M.	KRV	1200
1	20	Cr. Wh.		900
1	20	G.E.	I-K 2200 Volt	900
1	20	Cleve.	M	900
1	20	Al. Ch.		900
1	20	West.	MS 25 Cycle	900
1	18	West.	MS (Elev.)	720
1	15	F. M.	HLS	3600
4	15	F. M.	QZK B.B. New	1800
2	15	West.	MS 25 Cycle	715
1	10	Al. Ch.		1800
1	10	Imperial	EH B.B.	1200
1	10	West.	CS 25 Cycle	720
5	7½	G.E.	KT	1800
1	7½	West.	CS	1800
3	7½	Wagner	11VRW	1800
3	7½	G.E.	KT	1200
20	3	Imperial	E (New)	1200

Approx. 200 New motors from 2 HP—30 HP.

SLIP RING & SYNCHRONOUS

3 Phase, 60 Cycle, 220 or 440 Volt

(Other voltage as noted)

Qu	HP	Make	Type	Speed
1	443	El. M.	Syn.	900
1	300	G.E.	ATI Syn.	1800
1	100KW	G.E.	ATB Syn.	900
1	100	G.E.	I-16 2200 Volt	450
1	75	F. M.	BV 2200 Volt	1800
1	75	West.	(New) Syn.	1200
1	60	Ideal	AVX	1200
1	50	G.E.	I 25 Cycle	700
1	50	Al. Ch.		720
1	50	Ideal	AV 2200 Volt	600
1	40	G.E.	MT	1200
1	40	Al. Ch.		1200
1	40	G.E.	MT	900
2	40	West.	CW 2200 Volt	900
2	40	West.	CW	900
2	40	Al. Ch.		900
1	40	West.	CI	730
1	40	Burke	EMV7	1150/550
1	35	Al. Ch.		720
1	35	G.E.	I-12	600
1	30	Al. Ch.	2200 Volt	720
1	25	Cr. Wh.		1200
1	25	West.	CW	720
1	25	West.	MW	720
1	25	G.E.	MT Tot. Encl.	600
1	25	G.E.	MT	400

DC—230 Volt

Qu	HP	Make	Type	Speed
1	130	Cr. Wh.	CMC 550 Volt	1200
1	100	G.E.	CD	1200
1	100	West.	SK	1800
1	100	G.E.	RC38	600
1	100	G.E.	PCS 440 Volt	400
4	100	Cr. Wh.	CMC	225/550
1	75	Diehl	K11	700
1	60	West.	SK 115 Volt (Vert.)	1200
1	60	G.E.	EF1	1200
3	50	West.	SK	1200
1	40	Rel.	440 Volt B. B. Vert.	1800
1	40	Rel.	440 Volt B. B. (Vert.	1200/1800
1	25/40	Cr. Wh.	CMC 440 Volt (Vert.)	1200/1800
1	40	Rel.	B. P	400/1500
2	40	West.	SK	1200
1	40	G E	RC	1200
7	40	West.		775
1	35	G.E.	OMTRBB	1300
1	35	West.	SK	1200
1	35	Al. Ch.		1200
1	35	G.E.	DLC	700
2	30	El. Dy.	158	625/1250
5	30	Rel.	92TF	1800
1	30	Rel.	131T 440 Volt (Vert.)	1200
1	30	G E.	RC	1200
1	30 KW	Al. Ch.	110 Volt	925
1	27½	G.E.	CVC116	1800
1	25	Cr. Wh.	CM 110 Volt	900/1200
1	25	Al. Ch.	E120	500/1500
1	25	Rel.	25P	250/1000
1	25	G.E.	RF	300/900
1	25	F. M.	IRC	400/800
6	25	West.	SK	1200
7	25	West.	SK	950
2	20	Rel.	131T	1000/2000
2	20	West.	SK	750/1500
1	20	Diehl	K9	500/1000
1	20	G.E.	CD	400/1600
1	20	G.E.	RF	250/1000
1	20	Lincoln	FKW B. B.	1800
6	20	Cr. Wh.	CMC Enclosed	1800

DC—230 Volt

1	20	Cr. Wh.	CMC TEBB (Exp.)	1200
1	20	Rel.	92T	1200
2	20	West.	SK	1200
1	20	West.	SK	900
1	20	G.E.	RC	900
7	20	West.	SK	750
1	20	West.	SK	500
1	15	West.	SK63	1800
1	15	West.	SK113 Encl.	1800
1	15	F. M.	D B. B.	1150
6	15	Rel.	66T	1150
2	15	Cr. Wh.	CCM	1150
1	15	Cr. Wh.	CCM Tot. Encl.	1500
1	15	West.	SK93	1150
2	15	West.	SK80L	1150
1	15	G.E.	CD	1150
1	15	West.	SK90	850
1	15	West.	K8 Crane	630
8	15	Rel.	92TF	850/1700
2	15	G.E.	CO Crane	650/2700
1	15	Rel.	131T 115 V.	600/1800
2	15	West.	SK	600/1200
1	15	Rel.	78T	400/1600
1	15	G.E.	RF11	400/1200
1	12½	West.	SK	750/1500
1	12	G.E.	RF	575/1725
1	10	West.	SK7	850/1700
2	10	G.E.	RF10	600/1800
1	10	West.	SK90	600/1800
7	10	West.	SK80L	500/1500
20	10	Al. Ch.		500/1000
1	10	Rel.	92TF	400/1000
1	10	West.	SK	250/1000
6	10	Cr. Wh.	CM TEBB	1800
1	10	Century	R304	1800
15	10	West.	SK	1150
2	10	West.	SK 115 Volt	1150
3	10	Rel.	46TF	1150
1	10	G.E.	RC9	1150
2	10	Rel.	66TF	850
2	10	G.E.	RC	850
3	10	West.	SK70	850
1	10	G.E.	RC29 550 Volt	850
1	10	Colonial		950
14	7½	West.	SK33	1750
4	7½	West.	SK60	850
20	5	West. & Gen. Elec.		1750
20	5	West. & Reliance		1150
35	5	West.	SK 43	850

Hundreds of other DC motors not listed

27—New vertical, T.E.F.C.B.B., 3 Ph, 60 Cy, 220/440 volt as follows:
1—Fairbanks-Morse, 3 HP, ty. QZCU, Fr. 254, 1200 RPM Exp.
2—General Electric 3 HP, ty. K, Fr. 254, 1200 RPM
8—General Electric 7½ HP, ty. K, Fr. 324, 1200 RPM
8—Delco, 7½ HP, type C, Fr. 324, 1200 RPM
1—Howell, 7½ HP, type KV, Fr. 284, 1800 RPM.
5—General Electric, 15 HP, type K, Fr. 365, 1200 RPM
2—Howell, 15 HP, type KV, Fr. 365, 1200 RPM

1—New General Electric 250 HP, type KF, Frame 549-A, 440 volt, 3 phase, 60 cycle, 3600 RPM vert., direct connected to Bingham type 2, 22 stage, double case, 3600 RPM, 3820 head, 175 GPM

2—New Allis Chalmers 200 HP, type ARZ, 2300 Volt, 3 phase, 60 cycle, 3600 RPM, totally enclosed, fan cooled, ball bearing

1—150 KW Westinghouse synchronous M-G set, 275 volt DC, 4400 volt AC, 3 phase, 60 cycle, 900 RPM, AC control & DC panel
1—150 KW General Electric M-G set 250/275 volt DC, 440 volt AC, 3 phase, 60 cycle, 900 RPM
1—100 KW Ridgeway synchronous M-G set, 250 volt DC, 2300 volt AC, 3 phase, 60 cycle, 1200 RPM AC control & DC panel
1—200 KW Burke synchronous M-G set, 250 volt DC, 440 volt AC, 3 phase, 60 cycle, 900 RPM with AC control & DC panel
1—30 KW Westinghouse M-G set, 125 volt DC, 2300 volt AC, 3 phase, 60 cycle, 900 RPM with AC control & DC panel

6—Practically new 40 KW Reliance & General Electric variable voltage M-G sets, 250 volt DC, 220/440 volt AC, 3 phase, 60 cycle, 1800 RPM, complete with exciters, all control and drive motors. All motors ball bearing, enclosed. M-G set, exciters and control mounted in fan cooled enclosure. Drive motor G.E. type CD, frame 1441, 40 HP, 230 volt 400/1600 RPM, enclosed, ball bearing, 50° Cont. 250 RPM, 1 hr. 50°

The Wente Electric Co.

Hamilton — Rebuilt Motors and Generators Since 1906 — PHONE HAMILTON 707 — **Ohio**

LIQUIDATION SALE — MODERN EQUIPMENT

DIESEL ENGINES

	Make	Model	H.P.	R.P.M.	Cycle	Cylinders	Bore & Stroke	Year	Reverse & Reduction Gear
4	General Motors	16-258S	1800	900	4	16	9½" × 12"	1943	2.41:1 (fluid coupling)
2	Hamilton	R.B.99-D.A.	1600	700	2	9	9½" × 13⅜"	1944	
2	General Motors	12-278A	1200	750	2	12	8¾" × 10½"	1944	Falk 2.5:1
22	General Motors	12-567ATL	900	744	2	12	8½" × 10"	1942-44	Falk 2.5:1
2	General Motors	8-268A	500	1200	2	8	6½" × 7"	1943	2.54:1
2	Fairbanks Morse	38 O/P	300	1200	2	6	8" × 6"	1936	

A. C. DIESEL GENERATOR SETS

	Make	Model	H.P.	R.P.M.	Cycle	Cylinders	Bore & Stroke	Year	KW	Volts	Cycles	Phase	Make of Generator	DC Generator KW	DC Generator Volt
2	General Motors	8-268A	400	1200	2	8	6½" × 7"	1943	200	440	60	3	Westinghouse	40	120/240
1	General Motors	3-268A	150	1200	2	3	6½" × 7"	1943	100	400	60	3	Westinghouse	2	120

D. C. DIESEL GENERATOR SETS

	Make	Model	H.P.	R.P.M.	Cycle	Cylinders	Bore & Stroke	Year	KW	Volts	Make of Generator
7	General Motors	16-278A	1600	750	2	16	8¾" × 10½"	1943	1200	525 DC	Allis Chalmers (Type MHC 2290 AMPS)
2	General Motors	8-268A	500	1200	2	8	6½" × 7"	1944	375	120/180/240 DC	Westinghouse
24	Superior	GDB-8	150	1200	4	8	5½" × 7"	1942-44	100	120/240 DC	Delco (Model T362 3 wire stab. shunt 60° C rise 417 AMPS)
12	General Motors	3-268A	150	1200	2	3	6½" × 7"	1943-44	100	120/240 DC	Allis Chalmers
1	Fairbanks Morse	36A5½DE	100	1000	4	6	5½" × 7½"	1943	60	225 DC	Fairbanks Morse (Type DGZH compd. wd. 267 AMPS)
1	Caterpillar	D3400	26	1500	4	4	3¾" × 5"	1942	15	120/240 DC	General Electric (Model 52A1990 compd. wd.)

7—Blowers (Roots Connersville) size 16" x 18", connected to G.E. induction motor, 200 H.P., 3 phase 60 cycle, 2200 Volt, 705 RPM

2—Blowers (Roots Connersville) size 20" x 23" connected to Westinghouse Electric induction motor 350 H.P., 3 phase 60 cycle, 2200 Volt, 590 RPM

Blower Motors also sold separately.

TURBO-GENERATORS

8—300 KW G.E. type ATI 3/60/450, 1200 RPM, cond., compl. with 40 KW exciters, condensers, switchboards.

8—200 KW, G.E. type ATB 3/60/450, 1200 RPM, cond.

2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond. or non-cond.

2—375 KW West'hse 180/220 V, DC, 3000 Amp, 1200 RPM, cond.

1—300 KW 120/240 V, D.C. 1200 RPM

12—150 KW West'hse type SK, 120 V, DC, 1200 RPM, cond.

20—60 KW West'hse type SK, 120 V, DC, 1800 RPM cond.

NOTE — MANY GENERATORS FOR SALE SEPARATELY WITHOUT TURBINES

18—General Electric AC synchr. motors, 3 phase, 6000 HP, 93 1-3 cycle, 2700 V, 400 RPM, or 3800 HP, 60 cycle 1700 V, 257 RPM

28—DC 1500 HP W'hse, 525 V, 600 RPM

MOTOR-GENERATORS

AC to DC and DC to AC—various sizes from 1 HP to 80 HP.

CENTRIFUGES

15—Sharples
15—DeLaval
} Oil purifiers and oil clarifiers capacity 100 GPH and 150 GPH, with motors and pump

HIGH PRESSURE COMPRESSORS

from 700# to 3000# press.

DISTILLING PLANTS

4—Griscom Russell Soloshell double effect, 8000 gals. per day, complete with pumps

3—Cleaver Brooks Co., 5000 gals. p. day, self contained units complete with boiler pumps and fans

2—Foster Wheeler 40,000 gallons per day, triple effect low pressure

1—Condenser Service 80 tons per day, double effect

1—Vapor compression distiller, Badger & Sons, 750 gals. cap.

10—Same, 2000 gals. cap.

CENTRIFUGAL PUMPS

60—Various sizes up to 15,000 GPM, up to 725# disch. pr. steel and bronze motor and turbine driven.

GENERATORS

28—1200 KW DC Allis Chalmers, 525 V, 750 RPM

MOTORS

5—DC 25 HP, 35 HP, 50 HP, type CO 1808, 230 V, all variable speed 550 RPM to 2100 RPM

500—DC, from ½ HP to 80 HP, 120 V and 230 V, various speeds

BOILERS

2—Boilers, single pass., header-type, Babcock & Wilcox, built 1941, 22500# steam hr., at 250# press.

6—Express Boilers, modified D type, Foster Wheeler, 30,000# steam hr., 435# press., with economizers superheaters, desuperheaters, oil burners, etc.

2—Wickers Boiler 628 H.P. 3 drum. Navy Types, 250 pounds pressure.

6—Cyclotherm 3000 pounds steam per hour, 125# press.

12—Cleaver Brooks 2000# steam per hr, 30# press.

CONDENSERS

10—3800 Square Feet—⅝" copper-nickel tubes (new).

TURBO-BLOWERS

3—Sturtevant size 24—20,000 CFM at 17" S.P. turbine, 191 HP, 400# steam

SWITCHBOARDS

All sizes, AC and DC, whole or in parts, circuit breakers, current transformers switches, meters, recorders, etc., etc.

TRANSFORMERS

5—50 KVA
10—20 KVA
10—25 KVA 5—8 KVA
} from 440 V to 120 V, all single phase, 60 cycle, dry type

HOISTS

2—Mead Morrison Co., 2 drum hoisting engines type H197, driven by 51 HP G.E. motor 230 V, DC.

15—Main Drum 15000# pull at 78 FPM 3360# pull 348 FPM and 2 auxiliary drums. Driven by Chrysler 28.35 HP gasoline engine.

REFRIGERATION EQUIPMENT

25—Ice plants, cap ½ ton to 3.2 tons.

FANS

150—From 3,000 to 16,000 CFM at 2" to 3" S.P. with AC and DC motors

FEED WATER HEATERS

FUEL OIL HEATERS

BOILER FEED PUMPS

AIR COOLERS—HEATERS

Single section, 2 pass, double tube type

10—1860 sq. ft. surface, Westinghouse
17—1670 sq. ft. surface, General Electric
7—1290 sq. ft. surface, Westinghouse

FOR COOLING
FOR AIR CONDITIONING
FOR DRYING

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HUGO NEU CORPORATION

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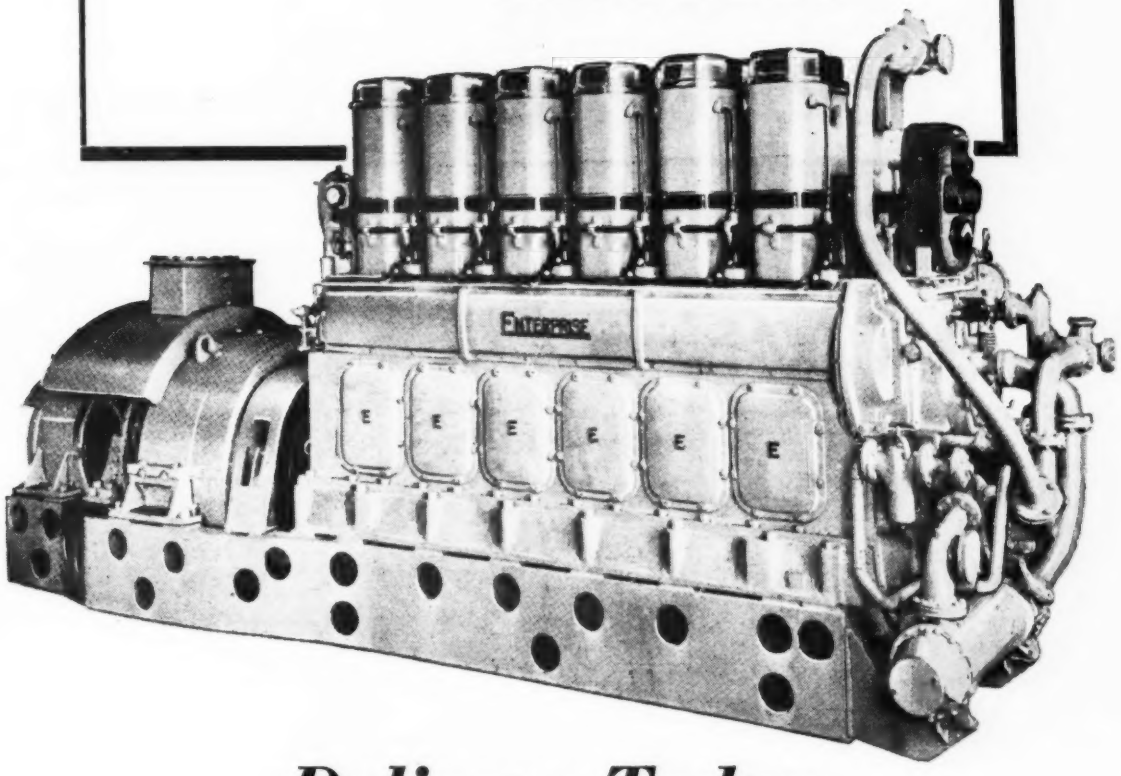
Tel.: REctor 2-1334

ARRANGE FOR INSPECTION

New ENTERPRISE *Diesels*



Delivery Today

COMPLETE GENERATOR POWER PLANTS

15—450 HP, Model DSG-6, 450 RPM, 12x15, 6 cylinder Diesel Engines direct connected to

15—250 KW, Elliott Direct Current Generators, 120/240 volt, 3 wire compound wound, 450 RPM. Complete with all necessary auxiliaries.

Large supply of brand new spare parts available

Many other important Diesel offerings from 15 KW to 1000 KW

Diesel Motors

WE HELP TO LIGHT AND POWER THE WORLD

PORT WASHINGTON, L. I., N. Y. **CORPORATION** TEL: PORT WASHINGTON, 2000

—for more than 40 years • • •

—A consistent policy of fair prices and full guarantee —has made WAGNER "Certified Rebuilt"

MOTORS, GENERATORS, M-G SETS

Pumps,—Fans,—Speed Reducers.

The CHOICE of MEN *WHO KNOW!*

M-G SETS

Others available—special units built to order

KW	Mfr.	Input V.	Output V.
150	Gen. Elec.	220/440 AC	125 DC
50	Whse.	220/440 AC	250 DC
40	Gen. Elec.	220/440 AC	250 DC
37½	Whse.	230 DC	3 ph. 240 AC
35	Gen. Elec.	220/440 AC	48 DC
30	Gen. Elec.	220/440 AC	125 DC
30	Marbie Card	220/440 AC	60 DC
105	Century b.b.	220/440 AC	70 DC
30	Elec. Prod.*	2200 AC	50 DC

*Synchronous motor drive

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
180	G.E. encl.	CL	230	800
100/150	G.E. dynamon.	TLC	250	1000/3500
80	Chand'son	D4C	115	200/600
75	Whse.	S13L	125	475
75	G.E.	BRC	115	1150
65	G.E.	C	230	375/750
60	G.E. b.b. (2)	CDM103	230	1750
50	Cr. Wheeler (2)	50H	230	700
60	Diehl dynamon.	R10	250	500/2000
35/50	G.E.	CD123	230	575/1150
50	Whse. b.b.	SK133	230	1150
45	P & H crane (2)	14X	500	440
30	Whse.	S-7	115	900
25	Chand'son (4)	C13	115	850
25	Roth	R8	230	1750
25	G.E.	DLC	230	750
25	G.E. b.b. New	CDM93	115	1150
20	G.E. b.b. New (2)	CDM83	115	1750
20	Imp. int. dty.	D37	230	1200
20	Reliance	T	230	850
20	G.E.	LC	230	575
20	G.E.	DLC	230	500/1500
20	P & H crane	10½X	500	625
20	Gen. Elec.	RC11	115	1150
20	Gen. Elec.	RCP29	230	1750
15	Gen. Elec.	RC10	115	1150
15	G.E. b.b. New (2)	CDM67	115	1750
15	G.E.	RC29	230	1700
15	Roth	R8	230	1750
15	Whse. New	SK83	230	1150
15	G.E.	RC10	230	1150
15	Whse. (6)	SK90	230	825
15	L. Allis b.b.	ONW444	230	575/1725
15	G.E.	LC	230	550
10	Marbie Card	b.b.	230	3450
10	G.E.	CD73	230	1750
10	Allis Ch. (5)	E80	230	1150
10	G.E. b.b. New (2)	CDM66	115	1750
10	Whse. crane	K-4	230	1070
10	Whse. b.b.	SK83	230	850
10	G.E.	CD83	230	850
10	Star b.b. New (2)	SQ20	230	900
10	Whse.	SK90	230	600
10	Whse. (2)	SK80L	230	500/1000
10	Reliance b.b.	92T	230	450/1800
10	G.E.	RE	230	400/1600

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	G.E. 1 brg.	MPC	125/170	1150
150	G.E.	C1	250	900
100	G.E.	TLC	250	1100
75	Whse.	S	125	600
70	Whse.	S13L	250	575
50	Cr. W eelet (2)	CCD	250	850
30	Lincoln b.b. 600	amp.	50	1200

SPECIAL BARGAINS

Centrifugal pumps up to 10 inch. blowers, all sizes, new & used. pressure pumps, 100 gpm. 1100#. pumps & rotary gear pumps. Fans & Oilgear Coolant

D.C. GENERATORS

KW	Mfr.	Type	Volts	Speed
24	Whse.	SK	600	850
25	G.E. b.b. New	CD93	125	1450
20	Allis Ch.		125	475
15	Imperial	HV	250	1450
12½	Engberg b.b.	MR	250	1150

A. C. MOTORS—SLIP RING

3 phase 60 cycle 220 or 440 volts

Qu.	H.P.	Mfr.	Type	Speed
1	400	G.E. 3 brg.	I-P	450
1	300	G.E. 2200 v.	I-M	1800
1	200	G.E.	IM-E13B	1800
1	200	Whse. 3 brg.	HF	600
1	100	Whse.	CW761C	1800
1	75	Whse.	CW	1200
1	75	G.E. b.b.	MT	1200
1	40	Allis Ch.	ANY	450
2	37	G.E. int. duty	ITC	1200
1	37	G.E. int. duty	ITC	600
1	35	Lancashire	b.b.	1800
1	30	G.E.	OMT336	1200
1	30	Whse. int. duty	C1	900
1	30	G.E.	MT346	600
1	25	Triumph	SR	1200
1	25	G.E.	I-M	900
1	20	P & H int b.b.	WT8	1200
1	15	P & H int. b.b.	W-7	1200
1	15	G.E.	I-M	900
1	15	Watson	KHV	720
2	10	Century New o.b.	SRT326	1200
1	200	G.E. 2200 v.	I-M	600
1	150	G.E.	I-M	600
2	150	G.E. int.	ITC	720
1	150	G.E. New b.b.	M	900
1	100	Lincoln	1XQ	900
2	100	Gen. Elec.	I-M	720
1	50	F. Morse	BV	720
2	40	Gen. Elec.	MT336	900
1	20	Gen. Elec.	MT322	900

A. C. MOTORS—SQUIRREL CAGE

3 phase 60 cycle 220 or 440 volts

Qu.	H.P.	Mfr.	Type	Speed
1	400	G.E. 2200 v.	I-K	1800
2	150	F. Morse	B	600
1	150	Gen. Elec.	I-E13A	1800
1	125	Cont. 2200 v.	SC	1800
1	125	Northwn.	H	1800
1	125	Cr. Wheeler	125Q	900
1	100	G.E.	I-K	600
1	100	Whse. vertical	CS	1200
1	75	G.E.	KT329Y	3600
1	75	G.E. 2200 v.	I-K	514
1	60	Howell b.b.	SC	1800
8	60	G.E.	K505	1200
1	60	Ideal	A306	1200
2	50	G.E.	I-K	1200
2	50	G.E.	I-K	900
1	50	Reliance b.b.	AA	720
2	50	Whse. vertical	CS766	900
1	40	G.E.	I-K	1200
1	30	Delco New	TEFC	1200
2	30	Gen. Elec.	KT526	1200
3	15	Reliance b.b.	B326	1800

SPECIAL—15 HP Gearhead Motors

Gen. Elec. K326 b.b. 3/60/220/440 V, output 234 RPM, like new.

▼

Also many speed reducers & gear motors in stock up to 15 H. P., new & rebuilt, at various speeds, A. C. & D. C.

A. C. MOTORS—SQUIRREL CAGE

Qu.	H.P.	Mfr.	Type	Speed
2	40	G.E.	I-K	900
1	40	Allis Ch. 3 spd.	ARX	900/600/450
1	40	Whse.	CCL	720
2	35	G.E.	I-K	720
2	30	Howell b.b. 4 spd.	SC	1800
1	30	Whse. New b.b.	CS405	1200
1	30	F. Morse	BH	600
2	25	Whse. New spl. b.b.	CS365	1800
2	25	U. S. b.b. New	SC364	1800
1	25	G.E.	I-K	1200
8	25	Whse.	CS586C	900
1	25	G.E.	KT526	900
2	25	G.E.	I-K	600
2	20	U. S. New b.b.	SC326	3600
1	20	G.E.	KT182	3600
2	20	Delco New TEFC	C264	1800
3	20	Whse. New sulprf.	CS364	1800
2	20	Century 4 spd. b.b.	SC504	1800
2	20	G.E.	I-K	1200
1	20	F. Morse	BH12B	900
2	20	G.E.	I-K	720
1	20	Whse. vertical	CS	1200
4	15	G.E. New b.b.	K324	3600
4	15	Whse. New b.b.	CS326	1800
2	15	Whse. New b.b.	CS364	1200
1	15	F. Morse vertical	Q326	1800
3	15	G.E. splprf. b.b.	K365	1200
2	15	Whse. b.b.	CS365	1200
5	15	G.E.	KT302	1200
3	15	Whse. TEFC b.b.	CS365	1200
2	15	G.E.	KT512	900
1	15	Allis Ch.	AR217	720
1	15	G.E.	I-K	720
3	200	Gen. Elec.	KTP557	1800
1	150	Gen. Elec.	KT557	1200
1	125	Century b.b.	SCN	1200
1	50	G.E. New b.b.	K405	1800
2	50	G.E. New hitorq	KG445	1200
1	50	Whse. New b.b.	CS505S	1200
2	30	G.E. New b.b.	K365	1800
2	30	G.E. New hitorq	KG365	1800
3	20	G.E. New hitorq	KG364	1800

A. C. MOTORS—SYNCHRONOUS

H.P.	Mfr.	Type	Volts	Speed
300	G.E.	AT1	220/440	600
300	El. Machy.	late	2200	360
225	Elec. Machy.	3 brg.	440	600
125	Whse.	G	220/440	900
125	G.E. spl. New	TS955	220/440	1200
100	KVA-Cr. Wheeler		220/440	900
75	El. Machy.	BRKT	550	900

A. C. MOTORS—25 CYCLE

H.P.	Mfr.	Type	Speed
456	Whse. 2200 v.	CW slipring	750
150	Whse.	HF slipring	500
156	Whse.	C sq. cage	500
100	Whse.	CCL sq. cage	500
50	Allis Ch.	ANY slipring	1500
50	G.E. Int.	MTC-5537	750
25	Whse. (4)	C sq. cage	750
20	Whse. (5)	C sq. cage	750
15	Whse. (3)	C sq. cage	750

A. C. GENERATORS—60 CYCLE

KVA	Mfr.	Type	Volts	Speed
625	G.E.	ATB	2300	450
500	G.E.	ATB	2300	450
250	G.E.	ATB	240/480	600
200	G.E.	ATB	240/480	600
150	Allis Ch.	B	2300	900
100	Whse.	G	240/480	900
100	Cr. Wheeler	103S8	240/480	900
100	Cr. Wheeler		240/480	600
75	Triumph	A15L	240/480	900
50	Cont. b.b.	S107	120 208	1200
25	Whse. b b. like new	1 phase	120	900

ARTHUR WAGNER COMPANY

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NEW *Never Installed*

SURFACE CONDENSERS

9300-Sq. Ft. to 100-Sq. Ft., Surface Type in Stock NEW
ALSO NEW CONDENSER AUXILIARIES
Circulating and Condensate Pumps, Air Evactors, Etc., Etc.

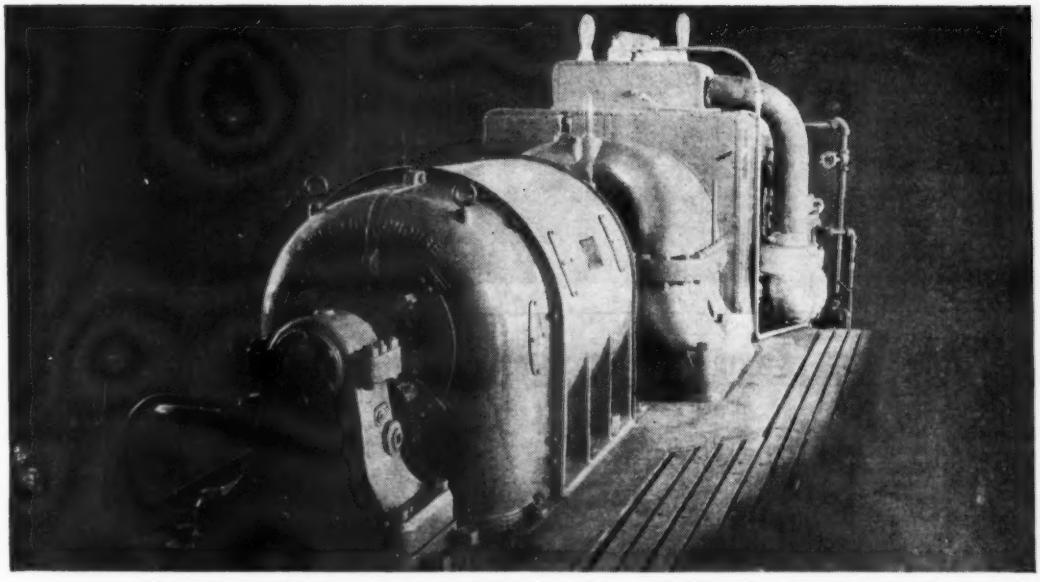
WE CAN SAVE YOU: 33⅓% TO 75%

OUR RECENT OUTRIGHT PURCHASE OF MANY THOUSANDS OF DOLLARS INCLUDES NEARLY EVERY ITEM USED IN POWER PLANT OPERATION

SPECIALS: 1—5000-KVA., G.E., 450#, 720 F.TT. 2300-volts
4—2250-KVA., 450#, 720 F.TT., 480-volts
2 of 2250-KVA., are Non-Condensing

TURBO-GENERATORS

NEW & USED
IMMEDIATE DELIVERY



Automatic Extraction, 625-KVA., Westinghouse Turbo-Generator 250#G. psi. 5/25# Extraction. Shaft Exciter Switchboard, Etc. Condition, Excellent

USED TURBO-GENERATORS: Partial List Only of Our Stock

5000-KVA. 450#, 720°-F.TT., 2300-V.
7800-KVA. G.E. 250#, 2300-V., Sur. Condenser
5000-KVA. G.E. 200#, 100-Deg., 2300-V.
3750-KVA. G.E. 200#, 2300-V., Condensing
2500-KVA. West., 200#, 2300-V., (1-GE.)
2850-KVA. G.E., 450#, 720°-F.TT., 480-V.
2500-KVA. G.E., Aut. Extr., 200#-psi., 25#-B., 480-V.
1865-KVA. Elliott, 350#, 550-F.TT., 2300-V.
1865-KVA. G.E., Cond., 200#, 2300-V.
1865-KVA. G.E., Aut. Extr., 200#, 30#-Back, 2300-V.
1250-KVA. Allis-C. Non-Cond. 160#, 25-Back, 2300/
937-KVA. Moore-Allis, Non-Cond., 200#, 25#-Back
937-KVA. Allis-Chalmers Cond., 200#, 480-V.
625-KVA. West., Aut. Extr., 250#, 25#-Back, 480-V.
625-KVA. G.E., Non-Cond., 200#, 25#-Back, 2300-V.
500-KW., Several Good Units Available

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THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.

2—6250 KW Gen. Elec. Cond. 25 Cycle
1—5000 KVA General Electric Cond.
1—4000 KW General Electric Cond.
2—3750 KVA Westinghouse Cond.
1—3750 KVA Westinghouse Extrac.
1—3125 KVA General Electric Cond.
2—3125 KVA General Electric Extrac.
2—1250 KVA General Electric Cond.
2—1250 KVA Elliott Cond.
1— 225 KVA General Electric Non-C.

STEAM ENGINE UNITS—60 Cy.

1—900 KW Hamilton Uniflow
1—750 KVA Chuse Uniflow
1—500 KVA Chuse Uniflow
1—450 KVA Ames Uniflow
1—375 KVA Harrisburg Uniflow
1—325 KVA Skinner Uniflow
1—312 KVA Ames Uniflow
1—312 KVA Corliss
1—300 KVA Skinner Uniflow
1—225 KVA Skinner Uniflow
1—150 KVA Harrisburg 4-valve
1—125 KVA Ames Uniflow

D. C. STEAM ENGINE UNITS

1—600 KW Ames Uniflow, 250 V.
1—500 KW Ames Uniflow, 250 V.
1—400 KW Ames Uniflow, 250 V.
1—350 KW Ridgway Uniflow, 250 V.
1—300 KW Skinner Uniflow, 275 V.
1—275 KW Ames Uniflow, 250 V.

DIESEL ENGINE UNITS

2—1600 HP Gen.Motors, 2400 V. 60 cy. gen.
1— 750 HP Worthington, 250 V. 60 cy. gen.
1— 750 HP Cooper Bessemer, 460 V. 60 cy. gen.
1— 720 HP Amer. Loco., 240 V. DC
1— 625 HP Worthington, 240 V. 60 cy. gen.
1— 500 HP Gen. Motors, 480-2400 V. gen.
1— 300 KW Buckeye, 450 V. 60 cy. gen.
2— 30 KW Buda 6DTG-317, 3-60-127/220 V.

WATER TUBE BOILERS

1—1409 HP B. & W., 650-lb. Stoker
2— 748 HP Edgemoor 250-lb. Stokers
2— 560 HP Erie City 460-lb.
1— 519 HP Titusville 200-lb. Stoker
5— 492 HP Heine, 180-lb. Stokers
2— 469 HP B. & W. 425-lb. Pulverizer

SYNCHRONOUS MOTORS

4—6000 HP G.E. 60 cy. 2300 V. 90 RPM
2—2000 HP West. 60 cy. 2200 V. 120 RPM
1—1750 HP West. 60 cy. 2300 V. 240 RPM
1— 500 HP G.E. 60 cy. 2300 V. 257 RPM
1— 300 HP G.E. 60 cy. 2200 V. 600 RPM
1— 300 HP West. 60 cy. 2300 V. 900 RPM
3— 150 HP West. 60 cy. 2300 V. 450 RPM
1— 100 HP G.E. 2300 V. 240 RPM (Super)

INDUCTION MOTORS

1—8000/1000 HP Cr. Wh. S/R 2200 V., FL 895/448 RPM
1—1000 HP West. S/R 2200 V. 360 RPM
1— 200 HP G.E. S/C 2300 V. 1800 RPM
1— 150 HP Cr. Wh. 440 V. 1800 RPM. New.
2— 150 HP Al. Ch. 2300 V. 1800 RPM. New.
2— 150 HP Burke S/C 440 V. 1800 RPM. New.
1— 150 HP G.E. S/C 440 V. 600 RPM
2— 120 HP G.E. S/C 220 V. 3600 RPM

MOTOR GENERATOR SETS

1—1500 KW Allis Chal. 600 V. DC, 60 cy.
1— 500 KW Cr. Wh. 275 V. DC, 60 cy.
1— 400 KW Cr. Wh. 275 V. DC, 60 cy.
1— 400 KW Allis Chal. 275 V. DC, 25 cy.
2— 300 KW Allis Chal. 275 V. DC, 25 cy.
1— 300 KW Westinghouse 250 V. DC, 60 cy.
1— 250 KW Allis Chalmers 275 V. DC, 25 cy.
2— 225 KW Gen. Elec. 115 V. DC, 60 cy.
1— 200 KW G.E. 2200 V. DC, 60 cy.
1— 75 KW Westinghouse 125 V., DC, 60 cy.
1— 50 KW Westinghouse 125 V., DC, 60 cy.

ROTARIES—60 Cy.

1—2000 KW Allis Chalmers 600 V.
1—1000 KW Allis Chalmers 600 V.
1—1000 KW Westinghouse 240 V.
1— 750 KW Westinghouse 275 V.
1— 750 KW General Electric 600 V.
1—500 KW General Electric 275 V.

FREQUENCY CHANGERS

1—2150 KVA G.E. 25/62½ cy. 750 RPM
1—1875 KVA G.E. 25/60 cy. 300 RPM
1—1200 KVA G.E. 25/60 cy. 300 RPM
2—1000 KVA G.E. 25/60 cy. 300 RPM
1— 938 KVA West. 25/62½ cy. 750 RPM
1— 600 KVA G.E. 60/25 cy. 300 RPM

TRANSFORMERS—60 Cy.

3—40,000 KVA Al. Ch. 63500/110000 Y-13800 V.
1— 1000 KVA G.E. 24000-11500 V. 3 ph.
2— 1000 KVA G.E. 23000-11500-575 V.
1— 3750/5000 KVA West. 22000/460 V. 3 ph.
2—10,000 KVA Pittsburgh 13200-4600 V. 3 ph.
2— 1000 KVA G.E. 11500/23000-575 V.
2— 2500 KVA Penn. 4150/2400-480 V.
3— 20 KVA West. 2200-575/287½ V.

OIL CIRCUIT BREAKERS

1—	400 A. 37 KV West. GII	Outdoor
2—	400 A. 25 KV G.E. FK0136	Outdoor
2—	1000 A. 23 KV Kelman CB76	Outdoor
6—	600 A. 15 KV G.E. FK255	Indoor
4—	600 A. 15 KV G.E. FHK0139-24BS	Outdoor
1—	600 A. 15 KV G.E. FK037	Pole type
2—	400 A. 15 KV G.E. FHK0136	Outdoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, New York

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—3000 KW 600 V Cond.
1—2000 KW 600 V Cond.
1—2000 KW 480 V Cond.
1—2000 KW 480 V N. C.
2—1500 KW 2300 V Cond.
1—1250 KW 2300 V Cond.
2—1000 KW 440 V Extrac.
1—1000 KW 2300 V Cond.
1— 625 KW 2300 V Extract.
2— 500 KW 600 V Cond.
1— 500 KW 240 V Cond.
1— 250 KW 240 V N. D.
1— 125 KW 600 V Extrac.
1— 50 KW 220 V AC. N.C.

ENGINE GENERATORS

2—600 KW 2300 V Uniflow
1—168 KW 600 V.
1—280 KW 480 V.
1—250 KW 480 V.
1—150 KW 180 V.
1—125 KW 125/250 V.D.C. Uniflow

TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#

BOILERS

1—50,000# 250 PSI
2—30,000# 425 PSI
2—507 HP 160#
1—500 HP 400#
1—460 HP 250#
1—200 HP 160# HRT
1—150 HP 150# HRT
1— 75 HP 150# NEW
2—175 HP 200# Mass. Std.

AIR COMPRESSORS

1—6000 CFM 50# Motor
1—1573 CFM 100# Motor
1—1300 CFM 50# Steam
1—1700 CFM 100# Steam
1—5000 CFM 10# G. Rotary Type Driven by 440 V Syn. Motor.

TRANSFORMERS

3—200 KVA 600/220/110

MOTOR GENERATORS

1—100 KW 550/125 V

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

The Buyers Must Be Satisfied—Always

FOR SALE

750 HP Fulton diesel 4 cylinder, 4 cycle, 500 KW 3 phase, 60 cycle, 440 volt generator. Complete.

750 KW GE condensing turbine 3 stage, 3600 RPM 3 phase, 60 cycle, 2300 volt, surface condenser.

25 KW International UD-14 portable diesel generator set, 220 volts. Like new.

MISSISSIPPI VALLEY EQUIPMENT CO.

507 Locust St., St. Louis 1, Mo.

TRANSFORMERS, TURBINES, MOTOR GENERATOR SETS, ROTARY CONVERTERS, BOILERS, CIRCUIT BREAKERS, MOTORS, ENGINE UNITS.

We buy and sell Electrical and Steam Machinery. Send us data as to your requirements; also send us description of equipment you have for sale.

ARCHER & BALDWIN, INC.

(Inc. 1917)

75 West Street, New York City 6, N. Y.

POWER EQUIPMENT BARGAINS

BOILERS—NEW

2—1500 HP 3 Drum B&W 300#, with superheaters, new and unerected, 150,000# Steam, with oil burners, casing, erection steel, soot blowers and safety valves. Built in 1943. Fine self-contained units.
3—1000 HP Combustion Engineering Co. 105,000# Steam, 300# pressure, with steel and casing, soot blowers, oil burners and safety valves.
10—600 HP, 440# Combustion Engineering Co. 49,000# Steam, superheaters, oil burners and trim.
2—500 HP, Combustion Engineering Co. Cross Drum, Sectional header, 440#, 750° T.T., oil burning.

STEAM TURBINE GENERATORS

1—5000 KVA 3 Ph. 60 Cycle 2300 Volt 440# late model G.E. Bleeder Type Turbine with auxiliaries.
2—750 KW G. E. 480 Volt Condensing Turbines.
1—200 KW Slightly Used 3 Ph. 60 Cycle 440 V. G. E. Condensing Turbine, 400# Pressure.
1—800 HP Westinghouse 4883 RPM, 535# PSI, 2 bearing.
2—2200 KVA 3 Ph. 60 Cycle G. E. 440# Condensing Turbines.

STEAM TURBO-GENERATORS, A. C.

6—312 KVA, Westinghouse, 1200 RPM (thru gears) 3 ph. 60 cyc. 440 V, 440# Pressure. NEW.
2—100 KW General Electric, 125 KVA, 4 wire, 3 Ph. 60 cyc. 240/110 V. 3600 RPM. Turbine 150/200 PSI.

STEAM TURBO-GENERATORS, D. C.

6—300 KW Westinghouse, 3 wire, 120/240 V, 1200 RPM, Turbine Condensing, 400 PSI, geared. NEW.
1—290 KW Westinghouse 120/240 V, 1200 RPM. Geared to turbine, 200# pressure, 4410 RPM. NEW.
1—50 KW Sturtevant, 125 V, 2800 RPM Turbine 150# Pressure.
1—35 KW G. E. 115 V. 3400 RPM Turbine 125# Pressure.
2—25 KW, Westinghouse, 125 V, geared to 7260 RPM. Turbine, 200# pressure.

TURBINES ONLY

1—275 HP G. E. Curtis Horizontal Turbine, 3600 RPM, 120# Pressure Condensing.
8—115 HP G.E. Horizontal Turbines, 4000 RPM, 435# Pressure, 10# B. P. NEW.
2—19 HP Terry, 18" Wheel, 1860 RPM, 235# Pressure, 10# B. P. NEW.

NEW SURFACE CONDENSERS

3—Surface Condensers 9500 sq. ft.
2—Surface Condensers 7900 sq. ft.
2—Surface Condensers 8200 sq. ft.
1—Surface Condenser 6300 sq. ft.
3—Surface Condensers 3300 sq. ft.
4—Surface Condensers 2200 sq. ft.
2—Surface Condensers 1500 sq. ft.
8—Surface Condensers 600 sq. ft.

HEATERS

8—Deaerating Feed Water Heaters, capacities 40,000 to 100,000# per hour. NEW.

AIR EJECTORS—NEW

5—Air Ejectors, New Twin, 2-Stage, for 8000 KW Turbine.
6—Air Ejectors, Twin, 2-Stage, New with inter and after Condensers for 6000 KW Turbines.
3—Air Ejectors, Twin, 2-Stage, New. With inter and after Condensers for 500 KW Turbines.
3—Air Ejectors, Twin, 2-Stage. New with inter and after Condensers, for 4000 KW Turbines.

EVAPORATORS—NEW

4—80,000# fresh or 40,000# salt water per 24 hr. day capacity Renauld Evaporators. Manifold cast bronze. Coiler SD copper tubing. NEW.
5—Paracoil-Davis, 90" high x 56" dia.

BLOWERS—NEW

2—82,000 CFM forced draft blowers driven by 253 HP steam turbines.
5—19,000 CFM at 10.8" Buffalo forced draft blowers, Type SL, Size 6-82 with control vanes. Direct connected to 50 HP, 3 ph. 60 cycle, 440 volt motor, variable speeds and capacities. (4 clockwise and 1 counter-clock).
2—15,930 CFM forced draft blowers driven by 30 HP motors.
3—5500 CFM forced draft blowers, steam turbine driven.

CIRCULATING PUMPS—NEW

3—3000 GPM Dayton-Dowd, vertical, centrifugal, split case, circulating pumps, 24.5' head. Direct connected to 25 HP 230 V, DC, 656/875 RPM ball bearing motors.
2—Circulating Pumps, 13,000 GPM.
6—Circulating Pumps, Main, 10,500 GPM.
6—1500 GPM, 25' head, vertical.

BOILER FEED PUMPS

8—470 GPM, De Laval, horizontal, centrifugal, 750 PSI discharge head, 5140 RPM. Powered by 320 HP, De Laval steam turbines, 2-stage 575# max. steam pressure.
3—200 GPM, Pacific, Size 2"S, horizontal, split case, 4 stage, centrifugal, 1380' head, 4" suction, 2" discharge, 4000 RPM. Direct connected to 115 HP, 4000 RPM, G. E. turbine, 435 PSI steam pressure. NEW.
9—200 GPM, Ingersoll Rand, 6-Stage, horizontal, 600# pressure, 1465' dynamic head, bronze impeller, 2½" suction, 1½" discharge. Direct connected to 125 HP, steam turbine, 150# pressure, 4125 RPM.
2—150 GPM, Pacific pumps, horizontal, centrifugal multi-stage, split case, 525# press., 1282' head, bronze impellers, 2" suction, 4" discharge. Direct connected to 110 HP, Westinghouse turbines, 4050 RPM, 440# max. steam pressure.
4—157 GPM, 12 x 8 x 24 Worthington, vertical, simplex steam pumps, 600# discharge pressure, 300# max. steam pressure, bronze fitted, 5" suction 4" discharge.

CONDENSATE PUMPS—NEW

24— 14 GPM, 143' head
9—150 GPM, 160' head
4— 35 GPM, 160' head
3—180 GPM, 220' head
6—150 GPM, 85' head

POWER PUMPS

1—Gardner Denver, horizontal duplex power pump, max. working pressure 1600#, max. speed 65., 4" suction, 3" discharge. NEW.
4—1-3/16 x 1-11/16, Deming, horizontal duplex, double acting, 10 GPM, suction lift 12', max. d'scharge pressure 120#, suction 1½", d'scharge 1". V-Belt driven by ¾ HP Peerless 230 Volt, 1750 RPM. Cpd. wound motors.

SIMPLEX STEAM PUMPS—NEW

5—14" x 11" x 18" Worthington vertical simplex steam pumps. 400 GPM, 125# discharge pressure, 140# max. steam pressure, 10# suction, 8" discharge.
2—12" x 14" x 18" Worthington vertical simplex steam pumps. 600 GPM, 50# discharge pressure, 140# max. steam pressure, 10# suction, 8" discharge.

DUPLEX STEAM PUMPS—NEW

13—7½" x 9" x 12" Worthington design vertical duplex steam pumps, 325 GPM, 230# steam pressure, 15# back pressure, 6" suction, 5" discharge.

FUEL AND LUBE OIL PUMPS—NEW

3—10" x 11" x 18" Worthington vertical simplex lube oil pumps, 325 GPM, 50# discharge pressure, 6" suction and discharge, 140# max. steam pressure.
5—225/325 GPM, De Laval, IMO, lube oil service pumps, 43# pressure, vertical. Direct connected to 15 HP 230 Volt, 950/1750 RPM Reliance DC ball bearing motors. NEW.
4—22 GPM, Kinney "Heliquad" horizontal rotary fuel oil pumps. Size 42-181, 325' head 20' suction lift. Direct connected 10 HP, 230 V G. E. DC motors through 4.15:1 reduction gear with speed regulating rheostat controllers.

FEED WATER REGULATORS—NEW

8—Hammel-Dahl Feed Water Regulators, remote control of liquid level for feed water heaters.

STEAM ENGINE DRIVEN UNITS

3—20 KW Marine Electric Co. Generators; 120 V, 500 RPM, compound wound, powered by Gault vertical steam engine. NEW.

D. C. GENERATORS & M. G. SETS

6—300 KW NEW Westinghouse DC 240 Volts 1200 RPM, 3 wire Generators. Can also offer same with 321 KVA 3 ph. 60 cyc. 440 Volt NEW Westinghouse Synchronous MOTORS.

CIRCUIT BREAKERS

10—2000 amp. 500 Volt AC 3 pole latest type G. E. Circuit Breakers. NEW.
2—5000 amp. 500 Volt AC 3 pole G. E. solenoid operated Oil Circuit Breakers.

MOTORS—DC—NEW

6—765 HP G. E. 2 Bearing 500 Volt DC 1030/1300 RPM.

STEAM DIESEL AND GAS ELECTRIC POWER UNITS

DIESEL ENGINES

2—950 HP Cooper-Bessemer, 300 RPM, 8 cylinder, 4 cyc. solid injection. UNUSED.
3—448 HP Baldwin, 4 cyc. 400 RPM. UNUSED.

DIESEL ELECTRIC POWER UNITS

3—290 KW, 240 V, Direct current, Generators, shunt wound, 1200 RPM (2 Westinghouse, 1 General Electric)
Direct connected to 500 BHP Gen. Motors, 8-cylinder Diesels, Model 8-268A.
If AC Generators required, we have available: 1 NEW, 2 Slightly used.
3—250 KW, 315 KVA, .80 PF. 1200 RPM Alternators 3 Ph. 60 Cyc. 450 V., 400 A. with 5.5 KW 1200 RPM shunt wound direct mounted Exciters. NEW. With used General Motors Diesels.
6—30 KW 3 Ph. Diesel Driven Power Units. Buda. NEW.

GAS ELECTRIC LIGHTING UNITS, AC

16—15 KW, 18.75 KVA Kato Generators, 3 ph. 60 cyc. 4 wire, 127/220 Volts, 1800 RPM, direct connected to Chrysler 6-cylinder engines. NEW.
24—10 KW, O'Keefe & Merritt Power Units, Single phase, 60 cyc., 120/240 Volt, 4 wire, 1800 RPM with 4-cylinder gas engine. NEW.
16—7.2 KVA, 5 KW, .7 PF Onan, 110 V, single phase, 60 cycle. NEW.

Subject Prior Sale

SUNDFELT EQUIPMENT COMPANY, INC.

3422 First Avenue South **MAin 1474** **Seattle 4, Washington**

QUALITY REBUILT POWER EQUIPMENT

MOTOR GENERATOR SETS

KW	Make	A.C.	D.C.
1000	G.E.	2300	600
800	Wtghse.	13200	250
600	C. Whir.	440	250
500	G.E.	6600	250
350	G.E.	440	250
150	G.E.	2300	275
90	G.E.	2300	60
75	G.E.	2300	125
75	Wtghse.	110	2200
70	G.E.	440	125
65	G.E.	440	125
60	A. Chlrs.	2300	110
50	C. Whir.	230	240
40	Bogue	440	125/250
40	G.E.	440	125
35	G.E.	220	40
30	G.E.	440	230
25	Watton	220	97/111

SQUIRREL CAGE MOTORS

H.P.	Make	Type	Volts	Speed
700	G.E.	IK	440	200
200	Wtghse.	CCL	440	1200
150	G.E.	TEFC	440	900
140	G.E.	K	440	1800
125	Howell	SC	440	1200
125	A. Chlrs.	FS	440	435
100	Cent.		440	1800
100	Wtghse.	CS	440	720
75	G.E.	KP	440	1200
75	G.E.	KT	440	3600
60	Wagner	TEFC	440	3600
60	A. Chlrs.	AR	440	495
50	G.E.	KT	440	1800
50	G.E.	IK	440	3600
40	G.E.	K	440	1800
40	G.E.	KT	220	680
35	G.E.	HI	440	515
35	Wagner		220	1165
30	G.E.	K	440	1800
30	Wtghse.	CS	440	1175
25	G.E.	TEFC	440	1200

SQUIRREL CAGE MOTORS (25 Cycle)

H.P.	Make	Type	Volts	Speed
60	Wtghse.	CS	440	715
20	Burke	EM	440	750
17	Burke	EM	220	500
15	G.E.	KT	220	725
7½	Burke	EM	440	500

SYNCHRONOUS MOTORS

H.P.	Make	Type	Volts	Speed
500	G.E.	TS	2300	450
450	E. Mach.		440	240
430	G.E.	ATI	2200	720
300	Ideal		2300	300
250	G.E.	TS	2300	600
75	G.E.	ATI	220	900
60	G.E.	TS	220	1200

GEARHEAD MOTORS

H.P.	Make	Type	Volts	Speed
5	G.E.	K	440	98.9
3	G.E.	KT	440	408
2	Ster.	KFA	440	230
1	U.S.	GH	440	350

SLIPRING MOTORS

H.P.	Make	Type	Volts	Speed
1200	Wtghse.	CW	2200	590
1200	Wtghse.	HR	2200	600
1000	Wtghse.	HR	2300	360
800	Wtghse.	CW	6600	300
750	Wtghse.	CW	2300	440
600	G.E.	M	440	1775
600	F. Mrse.	HV	4800	1800
500	Line.	I	440	900
435	G.E.	I	4000	1180
400	G.E.	MT	2200	450
400	A. Chlrs.		4000	1180
350	G.E.	I	440	720
300	G.E.	M	440	3365
300	G.E.	I	2300	1200
250	G.E.	I	2300	600
250	A. Chlrs.		440	505
200	G.E.	IM	2200	600
200	Wag.	BR	220	720

D. C. MOTORS (230 Volts)

H.P.	Make	Type	Volts	Speed
430	G.E.	MPC	250	950
300	G.E.	MP	250	425
200	Wtghse.	SK	230	1150
100	G.E.	RC	220	2500
60	G.E.	CD	550	1000
45	Wtghse.	S	250	650
40	C. Whir	CCM	230	575
40	G.E.	E	220	620
35	C. Whir.	CM	220	840
35	N. Wstern.		230	1275
30	C. Whir.	CCM	220	450
30	A. Chlrs.	Bull.	230	575
25	M. Card		220	745
25	N. Wstern.	K	230	900
20	A. Chlrs.	E	230	1150

(110 Volts)

65	G.E.	DLC	115	1000
25	C. Whir.	CM	115	750
15	G.E.	RC	115	850
10	G.E.	RC	115	1150
5	G.E.	RC	110	570

(Low Voltage)

1½	G.E.		60	1800
½	Wtghse.	SK	40	1150
¼	Leland	D	32	1725

VARI-SPEED D. C. MOTORS (230 Volts)

HP.	Make	Type	Volts	Speed
45	G.E.	TLC	250	1200/2500
40	G.E.	LC	250	825/2000
30	Tri.	JF	230	250/750
25	Wtghse.	SK	230	400/1200
20	Rel.	T	230	600/1800
15	G.E.	RC	250	500/700
10	Wtghse.	SK	230	400/1600
5	Ideal	D	230	1750/2190

(110 Volts)

60	G.E.	C	115	500/1800
30	G.E.	E	110	615/1230
20	Roth	RS	115	685/1165

A. C. GENERATORS

KVA	Make	Volts	Speed
1625	Wtghse.	2300	240
225	G.E.	440	600
175	A. Chlrs.	480	600
75	A. Chlrs.	240	1200
66	F. Mrse.	2360	300
50	C. Whir.	240	1800

D. C. GENERATORS

KW	Make	Volts	Speed
300	G.E.	250	1200
125	Mllw.	250	575
100	Burke	120/115	700
40	G.E.	125	1150
25	C. Whir.	120	1200
20	Bogue	125	1200
10	G.E.	125	500

AIR COMPRESSORS

1500 CFM Worthington 23x14x14 horizontal, water cooled, 125# P.S.I., d/c to 300 HP Allis Chalmers, synchronous motor, 3 ph., 60 cy., 4160 volts, 277 RPM, with access. m.g. set exciter, and syn. mtr. start. equip. 130 CFM Chicago Pneumatic, 8x8 NSB horizontal, water cooled, 100# P.S.I., 300 RPM, #12189 flywheel\pulley, air filter, can be furnished with 25 HP motor and access.

PUMPS

GPM	Head	Make	Motor
900	1200	Worth.	3/60/1800
700	1600	Worth.	3/60/1800
225	100	Ing. Rand.	115 D.C.
20/42	250/20	Aurora	Choice
20	10	Penrod	3/67/3450
10	10	Ruthmn.	3/60/1725

TRANSFORMERS (Air Cooled)

KVA	Make	Ph.	Pri.	Sec.
100	Wtghse.	1	240/480	120/240
30	Kuhl.	3	240/480	120/240
6	Sorg.	3	140	220
5	G.E.	1	440	55/110

CHICAGO ELECTRIC CO.

1320 West Cermack Road — **Chicago 8, Ill. Can. 2900**

MOTORS—M-G SETS—TRANSFORMERS

NEW MOTORS
3 ph. 60 cy.

Qn.	H.P.	Make	Volts	Speed	Type
60	1	Peerless B. Brg.	220/440	1800	P18S
5	2	West. T. E. F. C. B. B.	220/140	1800	CSP-224
2	2	Dayton B. Brg.	220/440	1200	225
2	2	B-Line B. Brg.	220/440	1800	224
3	2	Dayton B. Brg.	220/440	1800	224
3	3	Dayton B. Brg.	220/440	1800	225
4	3	West. T.E.F.C. B. B.	220/440	1800	225
1	3	West.	220/440	1800	CSP-225
2	3	West.	220/440	1200	CS-254
2	3	Brown & Brock.	220/440	1800	225
10	5	West. B. Brg.	220/440	1800	CSP-254
1	5	West.	220/440	1200	CSP-254
5	7½	West. T. E. F. C. B. B.	220/440	1800	CSP-284
5	10	West. T. E. F. C. B. B.	220/440	1800	CSP-324
1	15	G. E. B. Brg.	220/440	1800	K-326

TRANSFORMER

Qn.	KVA	Cycle	Voltage	Make	Type
10	5	60	2300/115/230	G.E.	H-K
3	7½	60	2300/115/230	West.	S
3	7½	60	2300/110/220	G.E.	H-K
3	10	60	2300/115/230	West.	S
6	10	60	2300/115/230	G.E.	H-K
3	20	60	2300/115/230	G.E.	H-K
2	30	60	2200/110/220	Kulhman	
3	15	25	2200/440/220	West.	
6	15	60	2200/110/220	G.E.	H-K
2	30	60	2300/115/230	G.E.	H-K
3	25	25	2200/220/440	Pitts.	OD
3	100	25	2300/115/230	G.E.	H-SP
1	150	25	2420/2200	West.	Stauto
3	150	25	2300/230/460	Wagner	Hedl
1	37½	25	2300/460/230	West.	SK
2	50	25	2200/220	Wagner	
1	75	60	2300/115/230	G.E.	H-R
2	100	60	2300/230/115	West.	S
1	300	60	4800/120/240	Pitts.	
1	325	60	4800/120/240	Kulhman	
3	200	60	2300/220/440	G.E.	H-SB
1	5000	60 3 ph.	13,200/240	West.	Late

A. C. MOTORS
3 ph. 60 cy.

Qn.	H.P.	Make	Type	Volts	Speed
1	7½	G.E.	KT-180	220/440	1800
2	10	W. B. Brg.	CS-326	220/440	1200
4	10	Al. Ch.	AN	220/440	1200
2	10	West.	CS	220/440	1200
1	15	W. B. Brg.	365	220/440	1200
5	15	Al. Ch.	AN	220/440	1200
1	15	G.E. B. B.	KT	220/440	720
1	20	G.E.	I-K	220/440	660
2	20	Wagner	BP	220/440	1300
1	25	G.E.	KT	220/440	900
4	25	Al. Ch.	AN	220/440	1200
1	25	Cr. Wh.	Sl. Rg.	220/440	1200
1	25	Lincoln		220/440	1200
2	30	W. E.	KT	220/440	900
3	30	Al. Ch.	AN	220/440	1200
2	30	West.	CS	220/440	720
3	35	G.E.	I-K	220/440	900
1	35	Al. Ch.	AN	220/440	1200
1	50	G.E.	KT-346	220/440	900
2	50	G.E.	K7337	220/440	1800
3	50	West.	CS	220/440	1800
2	60	Al. Ch.		220/440	1800
1	60	Rob. Meyers	K-209	220/440	1200
1	100	G.E.	I-K	220/440	1200
3	500	Elec. Mach.	Syn.	23000	514

1—500 KW. 25 to 60 cycle synchronous Frequency Changer, complete with panels.

A. C. MOTORS
3 ph. 25 cycle

Qn.	H.P.	Make	Type	Volts	Speed
5	5	Howell	SC-232	220/440	750
14	5	G.E.	KT	220/440	750
5	5	West.	CCL	220/440	750
1	7½	West.	CS	220/440	750
4	7½	G.E. Sl. Rg.	I-M	220/440	750
2	10	West.	CS	220/440	500
1	10	G.E.	I-M	220/440	750
1	10	G.E.	KT	220/440	750
1	15	Howell B.B.	SCR	220/440	500
1	15	G.E.	I	220/440	750
2	15	G.E.	IK	220/440	750
2	20	G.E.	IK	220/440	750
3	20	G.E.	KT	220/440	750
1	20	W. Sl. Rg.	CW	220/440	750
2	25	G.E.	I-K	220/440	750
1	25	W. Sl. Rg.	CW	220/440	750
1	25	Burke S. R.	WEV	220/440	750
2	25	G.E.	KT-337	220/440	750
2	25	West.	CS	220/440	750
2	30	Al. Ch.		220/440	750
1	50	G.E.	KT-353	220/440	750
1	50	Howell	Sl. Rg.	220/440	750
1	60	G.E.	IK	220/440	500
1	100	G.E.	I-K	220/440	750
1	200	West.	CS	220/440	750
1	200	G.E.	I-K	220/440	750
7	5	G.E.	KT	220/440	1500
2	5	G.E. Sl. Rg.	MT-181	220/440	1800
7	5	West.	CS	220/440	1800
1	7½	G.E.	I-K	220/440	1500
1	15	West.	CS	220/440	1500
1	25	Wagner	BP	220/440	1500
1	250	G.E.	I	220/440	1500

MOTOR GENERATOR SETS

1—150 KW Ridgeway Generator, 250 V. D.C. Motor —225 HP, 3/25/440 synchronous, with panels.
1—200 KW Ridgway 230/115 volt D.C. 3 wire, Factory Subase, direct driven by 300 H.P. Synchronous 3/25/2300 volt, with AC and DC Panels.
1—200 KW General Electric, synchronous, 50 volt D.C. direct driven 300 HP, type TS, 3/60/720 rpm, Complete with A.C. & D.C. Panels.

We buy for cash. Send us your list of surplus equipment.

Send us your inquiries

We have a large selection of 3 phase and 1 phase, 60 cycle welders.

VOLLAND ELECTRIC EQUIPMENT CO., INC.

1512 NIAGARA STREET — **BUFFALO 13, N. Y.**

PHONE GR 2715

REBUILT POWER EQUIPMENT—READY TO SHIP

M.G. SETS
250 V. D.C.
(Motors 220/440 or 2200 V. 3 ph. 60 cy.)

No.	KW	Make	Speed
2	15	West.	1150
1	20	West.	900
2	40	West.	850
5	50	West.	1200
2	75	Star	1200
2	75	G.E.	600
4	100	Star	1200
1	150	G.E.	1200

Can furnish M.G. Sets at 125 V.D.C. from 5 kw. up to 100 kw. for immediate shipment from stock.

DYNAMOMETER
"Hi-Ef" hydraulic size 35#, model 58S, 3100 rpm., Taylor Mfg. Co.

FREQUENCY CHANGERS
8—25 kw., 220/440 v. 3 ph. 180 cy., G.E. dir. con. to 25 HP, 1800 rpm., 220/440 v. 3 ph. 60 cy. motors.

COMPRESSORS
1—315 cu. ft. 100 lb. pres. Ingersoll-Rand, Models 315 and 315A portable Air Compressors with 105 HP Waukesha Oil Engines, complete with accessories.
1—630 cu. ft. 100 lbs. pressure Burry Horiz. Compressor.

INDUSTRIAL TRUCKS
5—Automobile type LO-5 Low Lift Electric Trucks capacity 5 ton platform type.
5—New 4 ton Yale & Towne Model Y8W Multi-stroke Hand Lift Platform.

INDUCTION HEATING CONVERTER
New Van Norman, type indoor, floor, hi-freq. 32 kw. 220 v. 1 ph., 60 cy. 150 A. enclosed type.

FIRE PUMPS
3—1000 GPM Worthington Cent. 1 stage, 6½" suc. 5" dis. 150# pres. dir. con. 133 HP., 875/1750 rpm., 230 v. DC Motors and control. (Can furnish A.C. Motors if desired.)

SPECIAL * A.C. Motors 3 ph. 60 cy.
1—1400 HP., West. SYN 2300/4000/440/220 v. 1200 rpm.
1—500 HP. Elec. Machy. Syn. 4000/2200/440/220 V. 120 rpm.
1—125 HP. G.E. type K, 220/440 v. 440 rpm.
11— 75 HP. Commonwealth 440 v. 1165 rpm., with Stearns Magnetic Brakes.
1—New 75 HP. West. type CS, 220/440 v. 3600 rpm.
60—New ½ HP., Diehl 220/440 v. 1725 rpm., tot. enc. BB.

DEGREASER
Blakeslee, Liquid fully conveyorized, immersion loading and unloading at opposite ends, 13' long 5'3" wide, 10'8" high with ¾ HP. A.C. motor. Conveyor speed 9 rpm., dual vapor control, gage glasses, thermometers, necessary piping and fittings, double strand chain conveyor with cross rods. 25"x20"x3" deep baskets, ¾" Sacro TR-40-3 Water Control, 1½" Sacro SF, 11 Vapor control, storage Tanks, #3 Still, Trans. pump and motors.

DUST COLLECTING UNITS
5—NEW portable, self contained ½ HP. A.C. Motors, overall Diam. 25"x14½"x23 single inlet, single outlet Fried Air Kool Co.

WINCHES
240—Winch assembly portable engine hoists, swivel hook, 4¾" l, with 1½" opening and 30' of ¼" cable. Hand cranked, double reduction gear with drum 5¾" w. can be used with A.C. or D.C. Motors.

PRESSES
2—Bliss hydro Dynamic marking vertical with 5 HP. A.C. motors 30 ton capacity.

FANS or BLOWERS
4—NEW 12000 CFM, Amer. Blower dir. con. 12½ HP. 2 speed A.C. Motors with starters.

A.C. GENERATORS, 3 ph., 60 cy.

KW	Make	RPM	Voltage
1250	West.	1200	220/440 2300/4000
450	Elec. Machy.	120	220/440 2300/4000
110	Allis Chal.	277	220/440
20	West.	900	120

WELDING AND PLATING SETS
1—Chandeysson 50 KW., 40 V. D.C. 600 rpm., 75 HP. Synchronous Motor 220/440 v. 3 ph. 60 cy., with exciter 100% P.F.
1—Thompson Shell Welder including West. control, 6 electronic tubes, ½ HP. A.C. Motor.
1—Federal special seam welder 200 kva., 220/440 v. 60 cy. 5 DC max. sec. amps. 34000 at ¼ x 33 throat, sec. volts 5.1 10.2 max. air pres. 90 min. water inlet pres. 65# 70 deg. F max.
1—Federal seam welder 150 kva., 220/440 v. 60 cy., .5 DC max. sec. amps. X30,000 at 4 BY-28 throat sec. volts 4-8 max. air pres. 90 deg. min. water inlet pres. 50 lbs. at 70 deg. F. 1 HP. AC. Motor.

CONDENSER OR SYN. MOTOR
500 HP. Elec. Machinery Co. SYN Motor 80% P.F. 120 rpm., 4000/2200/440 or 220 v. with exciter.

POWERPLANTS
5—NEW 1½ kw. Homelite portable 115 v. 1 ph. 60 cy. 1 cyl. air cooled 2 cycle gas or gasoline.
1—5 kw. Engberg Steam Engine 220 V. D.C.
2—5 kw. Portable Master Elec. 110/220 v. 1 ph. 60 cy. 4 cyl. Wis gas or gasoline engines 80% P.F. pneu. tires.
1—7½ kw. port. Master 4 cyl gas or gasoline 120 v. 1 ph. 60 cy. with pneu. tires and tongue.
2—10 kw. 120/v. Star Generators dir. con. to Hercules DIESEL, 250.
1—25 kw. 120/208 v. 3 ph. 60 cy. 80% P.F. West. Gen. dir. con. to Le Roi Gasoline Engine.
2—30 kw. 125/v. G.E. Generators dir. con. Buda DIESEL.
1—35 kva. Ridgway 220/3/60 dir. Con. Ridgway STEAM engine.
1—125 kva. West 240/480 v. 3 ph. 60 cy. West. dir. con. Erie Ball STEAM Engine.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

MOTORS • GENERATORS • TRANSFORMERS

MOTORS
3 PHASE—25 CYCLE—220 440 VOLTS

H.P.	Make	Type	Frame	RPM
5	West.	CS		750
5	West.	CS		750
5	West.	CS		750
5	West.	CS	453	750
5	West.	CS	453	750
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
10	G.E.	KT	312	750
15	G.E.	I Form K		750
15	West.	CS	573	750
20	West.	CS		730
25	West.	CS		730
40	G.E.	I Form K		750
75	G.E.	I Form K		800
100	G.E.	I Form K		750
100	West. (2200 v.)	CS	871/526	460
125	West (S.R.)	CW		480
150	G.E.	I Form K		365
150	G.E. (2200 v.)	I Form K		750
150	G.E. (2200 v.)	I Form K		750
150	Allis Ch.	Slip Ring		720
150	G.E. (2200 v.)	KT b.b.	557Y	1470
200	West. (2200 v.)	CS	1013	480
200	G.E. (2200 v.)	I Form K		485
200	G.E. (S.R.)	I Form M		480
200	West. (S.R.)	CW	1011	480

AIR COMPRESSORS
2—5000 CFM Worthington low pressure 45 lb. Compressors with 500 H.P. Gen. Elect. Motors. 3 phase 25 cycle 2300 volts.—Complete.

2300 VOLT PRIMARY CONTACTORS
1—225 HP. Square D Magnetic Controlled, 3/60/2200 Volts.
1—200 Amp Schweitzer-Conrad Load Break, 3 Pole Fused, 3/60/2200 Volts.

FREQUENCY CHANGERS
All Sizes in Stock. 60 cycle to 90 cycle. 100 cycle, 120 cycle, 180 cycle and any other high cycle if desired.

25 CYCLE TRANSFORMERS
3—667 KVA General Elect. Type H, Form VDDJ. Single Phase 25 Cycle 13,200 Volts Primary—with Taps—240/480 Volts Secondary.

60 CYCLE TRANSFORMERS
3—1000 KVA New Niagara Transformers, O.I.S.C. Single Phase 50/60 Cycle 12,000 Volts Primary 480 Volts Secondary with taps—Stock Shipment.

MOTOR GENERATOR SETS
2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP 3 Phase 25 Cycle motors.
1—30 KW Gen. Elec. Generator, Type DLC-203, 125 v. direct connected to 40 HP Gen. Elec. Motor, 3/440, 60/720 RPM with panel board.

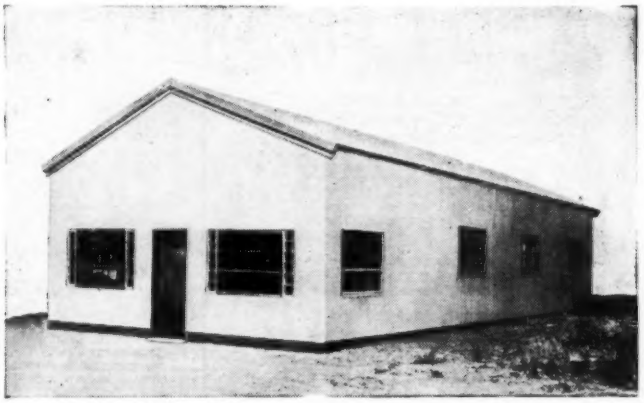
ROTARY CONVERTER
1—2000 KW Westinghouse Booster type Rotary Converter 230 Volt D.C.—3 to 6 Phase, 25 Cycle, 4600 Volt Transformer.

NEW MOTORS
300 New Gen. Elect. & Westinghouse Motors in stock from 1 to 100 H.P.

MOTORS
1—75 HP. Gen. Elect. Type I Form K. 3/60/440/720 RPM.
1—75 HP. Fynn-Weischel Synchronous 3/60/440/1200 RPM.
1—75 Gen. Elec. Slipring Type I Form M., 3/60/440/450 RPM.
1—100 HP. Gen. Elect. Type K (New Motor) 3/60/440/1800 RPM.
1—100 HP. Westinghouse Slipring Type CW, 3/60/440/435 RPM.
1—100 HP. Gen. Elect. Slipring Type I Form M, 3/60/440/2200/720 RPM.
1—100 HP. Westinghouse Motor Type CS-867A, 3/60/440/885 RPM.
1—100 HP. Westinghouse Slipring Type CW 3/60/440/1200 RPM.
1—170 HP. Crocker Wheeler Slipring 3/60/440/600 RPM.
1—200 HP. Gen. Elect. Slipring Type I Form M, 3/25/440/500 RPM.
1—500 HP. Allis Chalmers Slipring 3/60/2200/514 RPM.
1—500 HP. Gen. Elect. Type I Form K, 3/25/440/485 RPM.
1—600 HP. Westinghouse Motor Type CS, 3/25/550/490 RPM.
1—600 HP. Gen. Elect. Slipring Type MT, 3/25/550/490 RPM.
1—1500 HP. Allis Chalmers Synchronous, 3/60/2300/164 RPM.

ERIE ELECTRIC CO., INC.
124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

NEW and USED
STEEL BUILDINGS
SPOT DELIVERY



SIZES—40' x 100', 60' x 100', 80' x 100' and Larger.

Write for Complete Data on Sizes and Specifications

These buildings have the following attractive features:

1. **Ease and simplicity of erection.**
2. **Optional use of multiple bays to increase length or width.**
3. **Variable eave heights up to 30 ft.**
4. **Clear spans without supporting columns, up to 70' wide.**
5. **Unobstructed interior clearances.**
6. **Large door openings ranging in size from 10' x 10' to 20' x 20' with a choice of location and arrangement.**
7. **Adaptability to any type of business or industrial use.**
8. **Crane runways can be furnished for any bay in any building.**

A WIDE SELECTION OF
OVERHEAD CRANES

2-ton P&H 31'10¾" Span. Hoist motor 6 HP. Bridge motor 6 HP; trolley 2 HP. 220 Volts DC.
2½-ton P&H. 33' Span. Two 10 HP. on Hoist; two 1 HP. motors on trolley; one 10 HP. on bridge. Current: AC.
3-ton P&H. Span 42'1½". Three motors—8 HP. on bridge; 8 HP. on hoist; 1½ HP. on trolley. Current: 230 Volts DC.
5-ton Detroit. 34' Span. Three motors—7½ HP., 5 HP. and 1½ HP. Current: 220 Volts, AC.
5-ton P&H high speed crane. Span 72'1½. Current: 220 Volts DC. Two 40 HP. hoist motors, one 20 HP. on bridge; 6 HP. on trolley.
5-ton overhead crane. 37'2" Span. Hoist motor 10 HP; trolley 2 HP.; Bridge 7½ HP. Current: 440 Volts, 3 phase, 60 cycle.
5-ton Alliance. Span 95'. 220 Volts DC. Hoist motor 25 HP.; Bridge 50 HP.; trolley 15 HP.
10-ton Lane. Span 60' Two 15 HP. motors, one motor operates bridge and hoist, the other the trolley. Current: 230 Volts DC.
15-ton Bedford. Span 34'0" Span. 220 Volts AC.
15-ton overhead crane. 74'4" Span. 3 motors General Electric — 30 HP. on hoist.
20-ton overhead crane. 60' Span. Four General Electric DC motors.
25-ton overhead crane. 74'4" Span. Four General Electric motors—40 HP. on hoist; 15 HP. on auxiliary hoist; 15 HP. bridge and 5 HP. trolley.

A PARTIAL LIST ONLY

ECONOMY COMPANY, INC.
49P Vanderbilt Ave. **New York 17, N. Y.**

TWO NEW MODERN COMPLETE DIESEL ENGINE GENERATOR POWER PLANTS
WITH ALL AUXILIARIES, SWITCHBOARD PANELS AND INSTRUMENTS.

PLANT NO. 1—CAPACITY 561 KVA

Three 187 KVA, 3 phase, 60 cycle, 460 volts, 600 RPM Westinghouse alternating current generators each direct connected to a 240 HP Buckeye vertical full Diesel engine.

PLANT NO. 2—CAPACITY 375 KVA

Three 125 KVA, 3 phase, 60 cycle, 460 volts 600 RPM Westinghouse alternating current generators, each direct connected to a 150 HP Worthington vertical full Diesel engine.

UTILITIES ELECTRICAL MACHINERY CORPORATION
600 National City Bank Building Cleveland, Ohio

NEW BRONZE PUMPS

2—6" x 10" WORTHINGTON Horizontal, Type KLC, Duplex, Double Acting Power Pumps, with Solid Bronze Liquid End. Arranged for Motor Drive thru Silent Chain Drive, platform for mounting motor on pump. 6" Suc., 5" Dis. Capacity: 272 G.P.M. 175 lbs. Working Pressure, 57 R.P.M.

IN STOCK

DELTA EQUIPMENT COMPANY
148 N. 3d St. Phila. 6, Pa.

FOR SALE

4—50 KW Murphy Diesel Generating sets, Model ME-4, 4 cyl., 4 cy., 1200 RPM, Elec. start, Elec. Mchy. Co. Alternators, 3/60/120/208V., including radiator and panel, mounted on fabricated steel base.
2—50 KW Caterpillar Diesel Generating Sets, 6 cyl., 4 cy., 900 RPM, Model D8800, direct conn. to: 3/60/120/208 V. generators.
2—75 KW Caterpillar Diesel Generating Sets, Model D13000, 3/60/120/208 V., mounted on steel base, including radiator. A1 reconditioned.
New Chrysler Diesel Power Units, 75 HP, Model IND-3, 6 cyl., Elec. Start, includes: 4 Batteries, Radiator, and Spare Parts.

ALJOHN DIESEL CO., INC.
904 Pacific Street Brooklyn 16, N. Y.
Sterling 3-6515

Electrical Equipment

We build SUB-STATION equipment to fit your requirements. Highest quality A. C. and D. C. Motors, Control Equipment and Transformers

C. B. LOCKE CO.
P. O. BOX 3227
TEL. 38-136
CHARLESTON, W. VA.

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CONDENSING TURBO GENERATORS

3 Phase 60 Cycle

2000 KW 600 volt 155# G. E. #27000
1500 KW 2300 volt 150# G. E. #15000
1000 KW 2300 volt 150# G. E. 1916
500 KW 240 volt 175# Terry 1923

ENGINE GENERATORS—NON CONDENSING

3 Phase 60 Cycle

320 KW 220 volt 225# 100° S.H. Corliss Cross Compound
250 KW 220/440 volt 160# Corliss

11 KV TRANSFORMERS

Single Phaase 60 Cycle

3—1000 KVA 11000 to 2300
3— 500 KVA 11000 to 440
3— 500 KVA 11000 to 220/440
3— 300 KVA 11000 to 2200
3— 200 KVA 11000 to 2300
3— 150 KVA 11000 to 220/440
3— 125 KVA 11500 to 2300

WATER TUBE BOILERS

70,000#/Hr. B&W Stirling 200# 100° S.H. Pulverizer

30,000#/Hr. B&W Integral Furnace 425#, Pulverizer

750 H. P. Union Iron Works 250#, multiple retort stoker

467 H. P. Edgemoor 200# water walls, multiple retort stoker

250 H. P. B&W 225# 100° S.H. underfeed stoker

SPECIAL

2—Brand New C. E. C. Boilers

2—25,000#/Hr. 200# design pressure, 3 drum bent tube for oil firing

PAUL STEWART & CO., INC.

UNION TRUST BUILDING **CINCINNATI 2, OHIO**

Over 50 Years of Service

MOTORS—M. G. SETS—CONTROL

In Stock—Immediate Shipment—Rebuilt & Guaranteed

SQUIRREL CAGE MOTORS

3-Phase, 60-Cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
7	10	Whse.	C.S.	440	575
1	10	G.E.	KT-753	440	850
1	10	G.E.	K.R.	440	1090
1	10	G.E.	K-324	208	1750
1	10	Al. Ch.	X	220	1750
1	15	G.E.	K.T.	440	900
2	15	G.E.	K.T.	440	1160
2	15	G.E.	K.F.	440	3300
1	20	G.E.	I.K.	220	585
1	20	Whse.	C.S.	550	1750
1	25	G.E.	F.T.B.	220	575
2	25	G.E.	K.T.	220	900
1	25	Whse.	C.S.	220	1160
1	30	Whse.	C.S.	550	900
1	30	G.E.	K.T.	220	860
1	30	Whse.	C.S.	440	1160
1	35	G.E.	I.K.	2200	1200
1	40	F.M.	H	220	860
2	40	Al. Ch.	A.R.	440	860
2	40	F.M.	B	220	1150
1	40	G.E.	K.T.	220	1800
1	40	Whse.	CS-659	2200	1760
1	50	G.E.	I.K.	440	695
4	50	Whse.	C.S.	220	870
1	50	G.E.	K.T.	440	1160
1	50	Ideal	A.T.	440	1750
1	75	G.E.	FTR	440	720
1	75	G.E.	K.T.	440	875
1	75	Al. Ch.	A.R.	440	1750
3	75	Al. Ch.	A.R.	2200	1750
2	100	G.E.	I.K.	2300	695
1	125	Whse.	CS-761	440	1750
3	125	Al. Ch.	A.R.	2200	1750
1	150	G.E.	I.K.	220	575
1	150	G.E.	I.K.	550	720
1	150	Whse.	C.S.	440	1200
1	200	G.E.	I.K.	2300	490
1	200	Al. Ch.	A.R.	2200	3550
1	250	Whse.	C.S.	2200	1160

WE CAN SUPPLY WITH ANY OF THE ABOVE THE NECESSARY CONTROL EQUIPMENT ENGINEERED TO YOUR SPECIFICATIONS

ADJUSTABLE SPEED MOTORS

230-VDC.

Qu.	H.P.	Make	Type	R.P.M.
1	9	G.E.	RF-10	400/1600
4	10	Whse.	SK-91	250/1000
1	16	G.E.	RF-12	300/1200
3	10	Whse.	SK-90	400/1600
1	10/15	El. Dy.	7½-S	425/1275
1	14	El. Dy.	10-S	300/1200
1	15	Rel.	155-T	400/1600
1	15	El. Dy.	10-S	450/1350
1	15	G.E.	RF-10	550/1650
1	15	Whse.	SK-93	575/1725
1	15	El. Dy.	5-S	600/1200
1	15	R3l.	131-T	600/1800
1	19	Whse.	SK-100-L	600/1200
1	20	Rel	310-T	300/1200
1	20	Al. Ch.	E-130	400/1200
2	20	Whse.	SK-110-L	500/1500
1	25	G.E.	CD-128	200/ 800
1	25	G.E.	RF-13	400/1200
2	27½	El. Dy.	15-S	400/1350
1	30	G.E.	CD-105	875/1750
1	32½	Whse.	SK-150	400/1200
3	35	G.E.	RF-14	500/1500
1	35	Whse.	SK	400/1200
1	50	Whse.	SK-111	250/1000
1	60/80	El. Dy.	30-S	475/1425
1	60	Whse.	SK-131	500/1500
1	80	SPR.	C-60	480/1100
1	150/185	E. Dy.	75-S	250/ 500
1	200/250	Rel.	2600-T	400/ 800

WE CAN SUPPLY WITH THE ABOVE ADJUSTABLE & CONSTANT SPEED MOTORS—Manual—Semi-magnetic and manual and fully magnetic AUTOMATIC CONTROL. "ENGINEERED TO YOUR SPECIFICATIONS".

SLIP RING MOTORS
CONSTANT DUTY

3-Phase: 60-Cycle

Qu.	H.P.	Make	Type	Volts	R.P.M
2	10	G.E.	I.M.	220	1145
1	20	G.E.	MT-326	220	850
1	25	Al. Ch.	ANY	2200	860
2	25	G.E.	MT-326	2200	860
1	25	Whse.	C.W.	440	1750
1	30	Al. Chal.	ANY	440	900
3	40	G.E.	M.T.	550	560
3*	40	G.E.	I.M.	600	1170
1	40	Al. Chal.	ANY	2200	435
1	50	Al. Chal.	ANY	2200	490
1	75	G.E.	MT-548	440	1200
1	100	Whse.	C.W	6900	900
1	100	Whse.	M.W.-766	220	1200
1	150	G.E.	I.M.	550	385
1	150	Whse.	C.W.	2300	1160
1	200	G.E.	I.M.	2300	514
1	200	Cr. Wh.	127-AG	440	590
1	300	Al. Ch.	ANY	2200	514
1	300	G.E.	I.M.	2200	1200
1†	1200	Whse.	C.W.	2300	590

* 40-CYCLE.
† MILL TYPE WITH MILL CONTROL (MANUAL or MAGNETIC CONTROL for starting duty, or reversing and varying speed, can be supplied ENGINEERED TO YOUR SPECIFICATIONS.)

MOTOR GENERATOR SETS

2—10KW, General Electric 2-unit sets, 250-VDC., 1800-RPM., 220 or 440-V., 3-Ph., 60-Cy.
3—50 KW, Louis-Allis 250-VDC., 1200-RPM., dir. con. to 75-HP. sq. cg. motors, 220/440/2200-V., 3-Ph., 60-Cy.
2—90 KW, General Electric 250-VDC., 135-HP. sq. cg. motors, 220/440-V., 3-Ph., 60-Cy., 1200-RPM. B.B., splash-proof.
1—100 KW, Gen. Elec., 125-VDC., dir. con. to 150-HP., syn. motor, 2300/3/60-cy., 900-RPM., with complete control.
1—3-Unit Set (2) 90 KW, G.E., 250-VDC., Type CD generation, dir. con. to 200-HP. G.E. Syn. Motor, 1200-RPM., 2300-V., 3-Ph., 60-Cy., .8 P.F., with A.C. & D.C. panel.

SPECIAL
1—Practically NEW 500 KW, Al. Ch. Set 250-VDC., 900-RPM., 9300-V., 3-Ph., 60-Cy., motor—(3) 333 K.V.A. Whse. dry type Transformers, 13200/2400, synchr. motor control on 13200-V. side of transformers, with complete D.C. panels. We will sell this less transf., with 2300-V. synchr. motor control.
1—1000 KW, Whse., 275-VDC. Rotary Convertor, A.C. & D.C. Panels (3) 365 K.V.A., Al. Chal. transf., 1-Ph., 60-Cy., 2300-V.

T. B. MAC CABE COMPANY

4312 CLARISSA STREET PHILADELPHIA, PENNA.

SLIP RING MOTORS
3-PH., 60 Cy.

HP	Volts	Make	Speed
200	2200/440	G.E.	600
150	2200/440	G.E.	600
125	440/220	G.E.	600
150	440/220	Whse.	1200
125	440/220	G.E. (Holst)	900
125	440/220	G.E.	900
100	440/220	G.E. (MTC)	900
100	550	G.E.	900
100	440/220	G.E.	600
80	440/220	G.E. (MTC)	900
75	440/220	G.E. (MTC)	600
75	440/220	G.E.	720
60	440/220	G.E.	1200
60	440/220	Cr. Wh.	720
50	2200/440	G.E.	600
50	440/220	G.E.	900
75	550	G.E.	900
40	440/220	G.E.	720

SYNCHRONOUS MOTORS
3-PH., 60 Cy.

HP	Volts	Make	Type	RPM
200	440/220	Whse.	G	1800
300	440/220	G.E.	ATI	600
300	4150/2300	Cr. Wh.	SYN.	900
250	440/220	Whse.	HR	277
200	4150/2300	Whse.	G	1800
300	2300	G.E.	ATI	514
150	4150/2300	G	G	1800
150	440/220	G.E.	ATI	900
150	2200/440	G.E.	TS	600
135	2300	G.E.	TS	327
110	440/220	G.E.	TS	1800
110	440/220	G.E.	TS	257
100	440/220/25 cy	G.E.	TS	375
100	440/220	Whse.	G	1800
90	440/220	G.E.	ATI	1200

AIR COMPRESSOR UNIT
1—13" and 8" by 10" Worthington FEATHER-VALVE, 285 rpm, 110 lbs. ga., motor-driven, complete

CIRCUIT BREAKERS
1—2000 amp., ITE—3 pole—600 v., air circuit breaker

3—New 2500 amp., 600 v., type DA 75, 3 pole, Whse. air circuit breaker

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	900
400	550	G.E.	IK	720
300	2200/440	Whse.	CS	600
300	2200/440	Whse.	CS	600
300	440/220	G.E.	KT	1800
250	550	G.E.	IK	450
225	440	G.E.	IK	400
200	2200/550	Cr. Wh.	SC1	900
200	2200/440	G.E.	KT	1200
200	440	G.E.	IK	360
200	2200/440	Whs.	CS	600
150	440/220	Howell	B. Brg.	1800
125	440	G.E.	KT	600
75	220	G.E.	KT	1200
75	550/220	G.E.	KT	1200
75	440	G.E.	KT	400
60	440/220	Al. Chal.	AR	600
60	440/220	G.E.	KT	1800
50	440/220	G.E.	FTR	900

A. C. GENERATORS
1—300 kva., 600 rpm., 440/220 v., G.E.
1—225 kva., 720 rpm., 440/220 v., G.E.
1—190 kva., 514 rpm., 220/440 v., G.E.
1—150 kva., 900 rpm., 440/220 v., G.E.
1—100 kva., 327 rpm., 2300 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.
2— 75 kva., 1200 rpm., 440/220 v., G.E.
2— 30 kw., 1200 rpm., 440/220 v., G.E.

MOTOR GENERATOR SETS
1—100 kw., 125 v., 1200 rpm. Whse., conn. to 150 hp. 440/220 v., 3 ph. syn. motor.
1—75 kw., 250 v., 1200 rpm. Whse., conn. to 113 hp. 440/220 v., sq. cage motor.
1—25 kw., 440/220 v., 1800 rpm. G.E. alternator conn. to 40 hp. 330 v., DC motor.
1—60 kw., 125 v., 1200 rpm. Whse., conn. to 75 hp. 440/220 v., 60 cy., syn. motor.

TRANSFORMERS
60 Cycle
1—1000 kva, Al. Chal., 2400-120/240/208 volts, 3 phase.
1—400 kva, Al. Chal., 4000—2300 v., 3 ph. auto.
3—200 kva. Al. Chal., 2400-120/240 volts.
1—150 kva. Whse. SK, 13200-125/215 v. 3 ph
3—37½ kva. American, 7200—230/460 v., Pyranol.
3—100 kva, American, 2400-120/240 volts.
1—100 kva, G. E., type H-KS, 2400-240/120 volts.
6— 25 kva. G.E. DRY, 2400-120/240 v.
9— 25 kva. Whse., 440-115/230 v. dry new.

TURBO-GENERATOR
Generator, 125 kva, 1200 rpm, 440/230 v., Whse., dir. conn. by reduction gear to Turbine, 100 kw, 7380 rpm, non-condensing, 150/200 lbs. ga. pr., complete with dir. conn. exciter and switchboard: practically new condition, never used.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

TURBINE-GENERATORS

2—General Electric 2250-KVA, 3-phase, 60-cycle, 2300 volts, 3600 RPM Generator, direct-connected to General Electric 1800-KW, 3600-RPM, 10-Stage, Condensing Turbine, 410 lbs. throttle pressure, 28 to 28.5 inch vacuum. Complete with Surface Condenser and Condenser Auxiliaries. New — 1943. Used Approximately 3200 Hours and Like New.

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CAdillac 1856-1857

FOR SALE

ENGINE GENERATOR SET

SKINNER UNIFLOW ENGINE, 21" bore x 22" stroke, horizontal, poppet valve, center crank, non-condensing, double acting, simplex engine with rolling mill type frame. 150# initial steam pressure, 0-5# back pressure, 200 RPM. Mounted on cast iron bedplate and direct connected to:

BURKE 300 KVA ALTERNATOR, 3 phase, 60 cycle, 480 volts, complete with direct connected 15 KW, 125 volt Exciter and complete panelboard.

In good electrical condition as removed from service

$3500.

FOB Cars, Phillipsburg, N. J.

HEAT & POWER CO., INC.

70 Pine St., N. Y. C. Whitehall 3-2172

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1—250 KVA G. E. 60 cy. 1 ph. 7800—460
1—100 KVA G. E. 3 ph. 60 cy. 2300—460
12— 75 KVA New Atlantic, 60 cy., 1 ph. 2400—240/120
10—100 KVA New Atlantic, 60 cy., 1 ph. 2400—240/120
2—150 KVA 60 cy. 1 ph. 4160—240/120

ATLANTIC TRANSFORMER CO.
TRANSFORMER SPECIALTIES

5143 N. 2nd St. Philadelphia, Pa.

Steam Engine with alternator direct connected 100 K.W. 220 volt 3 phase, 60 cycle.

2 Babcock & Wilcox straight tube boilers 150 and 200 H.P.

Motors, 3 Phase 60 cycle 220 Volt, 1140 and 1750 RPM. All sizes, ½ to 30 H.P. New and used.

Aluminum Corrugated Roofing, new Condensers, 2000 and 1000 sq. ft.

B. C. SKINNER MACHINERY CO.

DUNEDIN, FLORIDA, Telephone 8-511

SINGLE PHASE—OISC

28— 3 KVA Whse. 6000 to 115/230 (new)
200— 15 KVA American 13200/110/220 (new)
3— 50 KVA G.E. 33000 to 2300 V.
5— 100 KVA G.E. 22000 to 220/110 V.
6— 200 KVA Whse. 11000 to 440/220 V.
2— 400 KVA Al. Ch. 66000/2300/4000 Y
3— 500 KVA G.E. 13200 to 575 V.
6— 500 KVA Whse. 24000 to 220/110 V.
3— 667 KVA Pack 11000/22000 to 440 V.
3— 667 KVA G.E. 22000 to 2200
2—1200 KVA Whse. 66000/2300/4000 Y.
2—2000 KVA Whse. 66000 to 220 V.
3—2000 KVA G.E. 13200/26000 to 2300 V.
3—2000 KVA Whse. 33000 to 1100 V.
3—2000 KVA G.E. 33000 to 13200/6600 V.
7—4000 KVA G.E. 15950/27600 Y to 13800/6900/4160 V.
3—1500 KVA Al. Ch. 33000 to 13200/6600 V.

THREE PHASE

3— 450 KVA G.E. 66000 Y to 440 V.
6— 650 KVA G.E. 13200 to 2300 V.
1—1200 KVA Whse. 6600 Y to 2300 V.
2—1500 KVA G.E. 13200 to 440 V.
3—1800 KVA G.E. 13200 to 550 V.
1—3000 KVA G.E. 11600 to 440 V.
1—15000 KVA Pitts. 27880 to 4560Y V.

WATER COOLED—SINGLE PHASE

4—5000 KVA 60 cy 60000 to 4000/6925 Y/8000/13850 V.
7— 750 KVA Whse. 33000 to 2200 V.
3— 675 KVA Whse. 33000 to 2200 V.

PYRANOL

1—3000 KVA Penna 25 Cy. 13800 to 480 V. 3 Ph.
19—37½ KVA Penna 440 V. to 220 V. 60 cy. 3 ph.

NETWORK TRANSFORMERS

19—150 KVA G.E. type Ht, late type, oil or pyranol cooled, 3 ph. 60 cy., 27060/125/216Y Vault or submersible type; attached to each transformer is G.E. automatic heavy duty network protector type MG 6 and heavy duty primary switch, complete with all accessories.
8—200 KVA G.E. Ditto.

STATION-TYPE REGULATORS

4—68 KW indoor type Westinghouse constant current regulators, Type R.S., Prim. 2200 V., 60 cy., Amp. 6.6 & 7.5 Serial Number 582020.

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1829 Cedar St. Phila. 34, Pa.

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Two 9' x 11' Harrington Chain Crate Stokers, capable of carrying two 600 horsepower boilers, complete with forced draft fan and vertical reciprocating engine 8 x 8. Completely dismantled and ready for immediate shipment.

MIDWEST MFG. COMPANY
Galesburg, Illinois

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STEEL ELEVATED WATER TANK
ON 90 FT. STEEL TOWER
DARIEN CORP.
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NEW ILG MARINE BLOWER FANS
24"—6250 C.F.M. 33"—10000 C.F.M.
36"—15000 C.F.M.
Axial Flow—Propeller Type Driven by 230 volt DC Motors.
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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

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MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

LARGE STOCK OF A.C. and D.C. MOTORS!

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	H.P.	Speed	Volts	Make	Type
1	3	1750	440*	West.	CW-232C
1	5	580	220*	G.E.	HI-9
6	7½	810	550	G.E.	MTC-5201
1	7½	575	220*	G.E.	MT-522
2	10	1140	440*	West.	HP-7A
2	10	570	220*	G.E.	HI-11
3	11‡	810	550	G.E.	ITC-5008
1	15‡	900	440*	G.E.	MTC-5302
2	15	570	220*	West.	CW-646
1	18	680	440*	West.	MW-316
1	25	1130	550	G.E.	MT-323
2	25	850	220*	Wagner	BR
2	25	720	440*	Wagner	22VBR
1	30	865	440*	West.	CW-646
1	30	850	440*	G.E.	MT-332
1	30	675	440*	G.E.	MT-336
2	35	600	440*	F-M	HV-H16A
2	40	865	2200	Al.-Ch.	ARY-223C
1	40	560	440*	G.E.	MT-346
1	50	860	440*	West.	HF-12A
5	52‡	550	220*	G.E.	IQC-5013***
1	60	685	440*	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW
1	75	720	550	G.E.	MT-556
1	80‡	575	440*	G.E.	MTC-5352
1	100	1760	220*	Al.-Ch.	ARY-223BS
2	125	430	440*	G.E.	IL-16
2	150	1750	440*	G.E.	MTP-549
1	150	720	2200	G.E.	I-M
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
3	250 (new)	360	440	West.	CW-20-53-15
3	300	900	440*	G.E.	IM-17
1	360	514	550	G.E.	IM-17A
1	400	505	550	West.	CW
1	700 720	2300/4000		West.	CU

* Can be furnished for either 220 or 440 volts but not both voltages.
‡ Intermittent rating.

230 VOLT CONSTANT SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
22	2	850	West.	SK-20
20	3	1150	West.	SK-20
10	3	850	Reliance	T-23T
25	3½	850	West.	SK-30
3	7½	1750/1310	West.	SK-43
2	7½	1150	G.E.	CDM-66
2	7½	875/1750	West.	SK-63I
3	7½	850	G.E.	CD-75
5 (new)	10	1150	Al.-Ch.	EB-80
1	10	850	West.	SK-83
10 (new)	12½	600	West.	SK-93
5	15	825	West.	SK-90
3	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	750	G.E.	RC
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	650	G.E.	RC-16
2	60	1750/1310	West.	SK-143
3	75	850	West.	SK-160
1	150	700	Al.-Ch	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
4	1½	1140	440*	West.	CS-225-TEFC
10	5	1730	440*	G.E.	K-254-TEFC
4	7½	1740	440*	G.E.	K-284-TEFC
1	10	1730	440*	G.E.	KF-324-TEFC
1	15	3485	220*	Reliance	AA-B3247
2	20	1160	440*	West.	CS-554
1	25	1140	2200	West.	CCL
1	25	705	440*	West.	CS-W504-TEFC
1	25	690	440*	G.E.	KT-336
1	30	870	220*	West.	CS-646
1	30	1160	440*	West.	CS-644
1	40	1200	440*	G.E.	KT-332
2	40	900	2200	G.E.	FTR-536
1	40	900	440*	G.E.	KT-536
1	50	850	220*	West.	CCL
2	60	900	440*	G.E.	KT-346
1	75	1750	2200	West.	CS-761
1	100	1765	2200	West.	CS-765A
1	100	870	440*	G.E.	KT-356
1	100	690	220*	West.	C
2	100	500	2200	West.	CS-930
1	100	495	2200	Al.-Ch.	AN
2	125	390	2200	G.E.	I-17-FR
2	150	1800	440*	Howell	N-684
3	150	1175	2300‡	G.E.	KTP-557
2	200	1750	440*	West.	CS-8558
4	200	580	550‡	G.E.	KT-5668
4	350	1750	2300	G.E.	K-559
1	500	1200	440*	G.E.	KTP-567
1	700	1800	2300/4000	West.	CS-4-39D-12

* Can be furnished either 220 or 440 volts but not both voltages. ‡ Reconnectable for 440 volts.

230 VOLT ADJ. SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
10	1½/2	500/200	G.E.	CD-65
1	2	225/900	Reliance	78T
6	5/7½	600/1800	G.E.	RA-30
1	12½	250/840	West.	SK-130
10 (new)	12½	600	West.	SK-93
1	15/20	500/1500	G.E.	CD-95
1	20	400/1600	G.E.	RF-12
1	20/25	300/1200	West.	SK-153
1	23/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-163
1	35	500/1500	West.	SK-143
3	40/50	400/1600	Al.-Ch.	EB-147
3	40/50	400/1600	Reliance	T-388T
1	75	500/1500	Cr.-Wh.	CCM
1	75	375/750	Cr.-Ch.	CMC-125H
5	100	400/1200	Al.-Ch.	
1	100	320/960	West.	SK-200
1	175	230/750	West.	SK-220
2	375	350/500	G.E.	MPC

CRANE, MILL TYPE 230 V. D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
2 (115 v.)	3½	700	G.E.	CO-1803
2	5½	760	West.	MCB-20
1 (new)	10	650	G.E.	MD-403-BE
1	15	630	West.	K-5
1	20	515	West.	K-6
3	25	590	Diehl	TE
2	27	490	West.	MC-40
2	35	750	G.E.	CO-1828
3 (new)	35	600	West.	CK-9
1	50	750	G.E.	CO-1829A
1	50	600	West.	CK-9
5 (new)	50	525	G.E.	COM-1830AE
1	59	470	G.E.	CO-2007
2 (new)	60	550	G.E.	COM-1831AE
4	65	450	G.E.	COM-1830

VARIABLE VOLTAGE DRIVES

40 HP. Reliance, Variable Voltage Drives, each Consisting of:
1—40 KW. 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP. 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

NEW A. C. MOTORS IN STOCK
SQUIRREL CAGE, BALL BEARING 1800 RPM, 3 Ph., 60 Cy., 220/440 V.

Qn.	H.P.	Make	Type
15	1	G.E.	K-203
15	2	G.E.	K-224
15	3	G.E.	K-225
15	5	G.E.	K-254
10	7½	Al.-Ch.	AR-284
7	7½	G.E.	K-284
6	10	G.E.	K-324
2	20	G.E.	K-364

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We have Controls for Most Items Listed.

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STEAM—ELECTRIC—HYDRO—DIESEL

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1—10000 KVA 3 phase, 60 cycle, high tension Transformer
1400/2200 KW Turbo-Generator, non-condensing, Excellent Condition

1—90,000# Boilers 575#
2—60,000# Boilers 250
4—1000 H.P. Heine Boilers 225#
2— 325 H.P. B & W Sterling Boilers 200#
2— 600 H.P. Edge Moor 200# Stokers
Smaller Boilers and Tire Tube Boilers also
2—3000 K.W. Turbos @ 350#

2—2500 K.W. G.E. Co., Turbo-Generator Condensing
2—2000 K.W. G.E. Co., Turbo-Generator Condensing
1—6500 K.W. G.E. Co., Turbo-Generator Condensing
1—2000 K.W. W.E., & M. Co., Turbo-Generator Con.
2—1000 K.W. G.E. Co., Turbo-Generator Condensing
2— 750 K.W. G.E. Co., Turbo-Generator Condensing
Several 500 KWs & Smaller Units

Non-Conducting Turbos—300—500—750—and 1,000 K. W. & Larger

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D. C. GENERATORS, ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES, VOLTAGE AND CYCLES

3 ph. 60 cy. A.C. Motors
3 ph. 25 cy. Motors
125 Volts D.C. Motors
230 Volts D.C. Motors
550 Volts D.C. Motors

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BERGER BROTHERS Electric Motors, Inc., 395 STATE ST., ROCHESTER 4, NEW YORK
PUT ALL IDLE EQUIPMENT TO WORK. SEND YOUR LIST FOR PROMPT ACTION.

TURBO GENERATORS and BOILERS

1000 KW., 3 phase, 60 cycle, 480 volt, 3600 RPM., General Electric. rigid frame type non-condensing, 160 lbs. and 25 lbs. back pressure.
750 KW., 3 phase, 60 cycle, 2300 volt, 3600 RPM., Gen. Elec. rigid frame type, non-condensing 125 lbs. and 5-10 lbs. back pressure.

750 KW., General Electric rigid frame type 3600 RPM., 150 lbs. extraction 10 lbs. Generator can be wound for 220, 440, 550 or 2300 volts.

SMALL SIZES IN STOCK

6—400-500 HP steel encased water tube Heine boilers. Cross drum type.

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Power Plant Equipment Company

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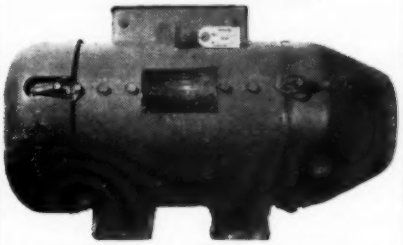
MOTOR GENERATORS



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K.V.A. output 1,250 — R.P.M. 3600
K.W. output 1. — Cont. Duty Ph. Single
P.F. 80 — Cycles 60
Volts input 115 D.C. — Volts output 120 A.C.
Amps input 14 — Amps output 10.4
Length 26"; width 12⅞"; height 13"

Compound accumulative A.C. and D.C. fields. Centrifugal starter. Splashproof covered. Frequency adjustable to load, plus or minus five cycles.

PRICE $87.50

Identical Machine, but 230 volts D. C. input, $125.00
Set of Replacement Spare Parts for Either Machine $29.50
Prices f. o. b. Tuckahoe, New York
Immediate Delivery

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ELECTRIC—STEAM—GASOLINE DRIVEN.
All Makes — Capacities — Pressures.
Centrifugal — Rotary — Plunger — Turbine.

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STANDARD EQUIPMENT — UP TO 200 H.P.
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New & Rebuilt Guaranteed Machines.

TURBO BLOWERS
SPENCER—INGERSOLL RAND—ALLEN BILLMYRE. For Heat Treating — Brazing Furnaces — Smelting — Vacuum Duty Etc.

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VACUUM RETURN
STEAM UNITS

AIR COMPRESSORS
ALL TYPES—CAPACITIES 1 to 1000 "CFM"
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BOILERS

2—404 H.P. Springfield, oil burners 170#
1—550 H.P. W.W. sectional header 200#
4—300 H.P. Casey-Hedges, oil, 165#
2—25,000# Stirling's, pulverizers, 425#

Other sizes and types

H. P. BREARLEY
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SPECIAL

450# 720° F.TT. GENERAL ELECTRIC TURBO-GENERATORS Immediate Delivery

WITH NEW (Never Used) SURFACE CONDENSERS And NEW Condenser Auxiliaries

1—5000-KVA. General Electric, 450#-psi., 720° F.TT., 3/60/2300-Volts
4—2250-KVA. General Electric, 450#-psi., 720° F.TT., 3/60/480-Volts
2—2250-KVA. Gen. Elec., 450#720° F.TT., 50#-B.P., 480-V. Non-Cond.

Slightly Used. For Service Guaranteed Same as New Machines

Brand NEW (Never Used) SURFACE CONDENSERS and NEW CONDENSER AUXILIARIES

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500 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM. 6 PH. 60 CY. SWITCHGEAR AND TRANSFORMERS.

300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM. 6 PH. 60 CY. SWITCHGEAR AND TRANSFORMERS.

MOTOR GENERATORS

500 KW G.E. SYN. 600 V. 2200/4000 A.C. 1200 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

300 KW RIDGWAY SYN. 250 V. 2200 A.C. 1200 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

150 KW G.E. SYN. 250 V. 2300 A.C. 1200 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

Each unit listed above is owned by us and is available now for immediate purchase

WALLACE E. KIRK COMPANY
Incorporated
502 Grant Building, Pittsburgh, Pa.

MOTOR GENERATOR SETS
New 1942-1944

1000 KW, 230 Volts DC, *GENERAL ELECTRIC* 720 RPM, motor synchronous, 2300 Volts, 3 phase, 60 cycle (one Unit)

1000 KW, 550 Volts DC, *ALLIS CHALMERS*, 720 RPM, motor synchronous, 2300 Volts, 3 phase, 60 cycle (6 units)

600 KW, 500 Volts DC, *ELLIOTT*, 720 RPM, motor synchronous, 2300 volts, 3 phase, 60 cycle (4 Units)

300 KW, 125/250 Volts DC, *WESTINGHOUSE*, 1200 RPM, Generators only. Will supply suitable motors (4 Units)

100 KW, *ELECTRIC PRODUCTS CO.* AC Generator, 3 phase, 60 cycle, 440 Volts, 1200 RPM. Motor—*RELIANCE* 150 HP, 230 Volts DC, Complete switchgear (2 Units)

Immediately available.

A. G. SCHOONMAKER COMPANY, INC.
50 CHURCH STREET, NEW YORK
Established 1898 **Worth 2-7225**

Most all units still on foundation. Many may be seen operating

DIESEL UNITS

375 KVA GE 2300/440 v.—Worthington 6 cyl.; dir. con. exciter and sb
375 KVA Fairbanks Morse, 480 v.—Model 32E-14
250 KVA Fairbanks Morse 2300/440 v.—Style VA
225 KVA Westinghouse 2300/440/220 v.—Worthington
187 KVA Fairbanks Morse 2400/440/220 v.—Marine Type
185 KVA Fairbanks Morse 2300/440/220 v.—Model 32E-14
156 KVA Ideal 240/480 v.—Buckeye
93.8 KVA Electric Machinery—Superior
75 KVA General Motors 440/220 v.

TURBO UNITS (NON-COND.)

3714 KVA Westinghouse 240/480 v.
125 KVA Crocker Wheeler 240/480 v.—Moore
155 KVA (2) Allis Chalmers 220/440 v.—Terry
250 KVA General Electric 220/440 v.—General Electric
250 KVA GE 600 v.—GE 30# BP
280 KVA General Electric 2300 v.—Terry
625 KVA Elliott 480/240 v.
2500 KVA General Electric 480/240 v.

TURBO UNITS (COND.)

375 KVA Allis Chalmers 480/220 v.—Kerr
750 KVA General Electric 240/480 v.
940 KVA Westinghouse 2300 v.
940 KVA Westinghouse 6600 v.
1250 KVA Westinghouse 2300 v.
1250 KVA General Electric 600 v.
1250 KVA (2) Allis Chalmers 4000/2300 v.
1875 KVA (2) General Electric 2300 v.
2500 KVA General Electric 600 v.

BOILERS

250 HP Erie City 180#
300 HP Erie City 200#
403 HP Sterling 250#
406 HP (2) Heine 180#
467 HP (3) Edgemoor 200#
469 HP (2) Sterling 425#
500 HP Murray 200#
502 HP (2) Edgemoor 250#
514 HP Erie City cross drum 200#
1038 HP Springfield 200#

STEAM ENGINE SETS, A.C.

79 KVA Allis Chalmers 480/240 v.—Ames Unif.
187 KVA General Electric 240/480 v.—Chuse 4 v.
187 KVA Westinghouse 240/480 v.—Ames Unif. Ver.
300 KVA General Electric 2300 v.—Murray Corliss
375 KVA General Electric 2300/440 v.—Chuse 4 v.
450 KVA General Electric 2300/440 v.—Ames Unif.
500 KVA Crocker Wheeler 240/480 v.—Nordberg Unif.
750 KVA General Electric 2300/480 v.—Chuse Unif.
688 KVA Allis Chalmers 600 v.—Al Chal. Corliss

MOTORS OR GENERATORS SYNCHRONOUS

375 KVA General Electric 2300/440 v. 277 RPM
250 KVA General Electric 240/480 v. 277 RPM
2000 HP (3) Westinghouse 2300 v. 120 RPM
500 HP (3) Electric Machinery 2300 v. 514 RPM
450 HP (2) Westinghouse 2300 v. 128 RPM

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt St. New York, N. Y.

BOILERS

2—1847 HP Heine Boilers 200#
4—1010 HP Heine Boilers 200#
2— 786 HP B. & W. Stirling 180#
2— 750 HP B. & W. Stirling 190#
1— 650 HP Casey Hedges 225#, 1932
1— 519 HP Titusville 3 drum Boiler 200#
2— 404 HP Springfield Sec. Header Boilers 200#
3— 318 HP B. & W. Stirling Boilers 200#
4— 250 HP HRT Boilers, 200#
1— 216 HP Vogt 3 drum Boiler 160#
1— 80 HP Cyclotherm Steam Generator 125# (New)
1— 40 HP Leffel Scotch Marine Boiler 125#

TURBINES

1—750 KW Westinghouse Turbo Generator, 250# pressure, 100° superheat, 2300 volts, all auxiliaries, recently rebuilt.
1—6250 KW General Electric, 1800 RPM, Condensing, all auxiliaries.
1—750 KW 3-60-240 volt General Electric Automatic Extraction.
1—3700 KVA General Electric Condensing Turbine.
1—500 KW General Electric Condensing Turbine.
1—2000 KW General Electric Condensing Turbine.

DIESEL ENGINES

1—360 KW Chicago Pneumatic—480 Volts—New.
2—100 KW McIntosh-Seymour, 3-60-2300 volts, all auxiliaries.
5—100 KW General Motors Diesel Engine Generator Sets, 110-240, D.C. new 1942.
4—300 KW General Motors Diesel Engine Generator Sets, 110-240, D. C. new 1942.

ENGINE GENRATOR SETS

1—27"x36" Skinner Uniflow, direct connected to 562 KVA AC Generator, complete.
1—565 KVA Skinner Uniflow Engine Generator.
1—375 KVA Harrisburg Uniflow Engine Generator.
1—28"x36" Hamilton Uniflow direct connected to 750 KW, 3-60-2300 volts, all auxiliaries.
1—450 KW Skinner Uniflow Engine Generator, 2300 volts, 14 years old.
1—125 KVA Skinner Unaflow Engine Gen. 3/60/240.

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1—650 HP Casey Hodges Water Tube Boiler, 225# pressure, complete with all Trim Copes Regulator, Combustion Engineering Stoker. Boiler new 1932. Available for immediate shipment.

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1—250 KW GE turbo-generator unit. Steam conditions 525#. 350° superheat, condensing. Generator 3-phase, 60 cycle. 450-volts, 1200 RPM with 40 KW exciter.
Machine New in 1941

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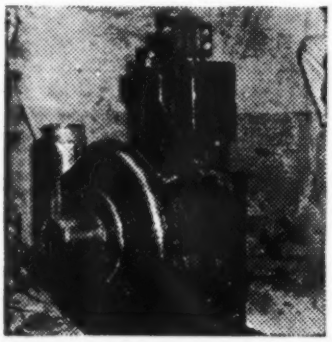

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Centrifugal Hi-Pressure Blower, single stage, closed type impeller, 1000 CFM at static pressure of 11.2" water at 70° F. Mfg. by Buffalo Forge Co., complete with G. E. Motor, 5 h. p., 3450 RPM, 60 cycle, 3 phase, 220/400 volt, AC current, magneto starter and push button station. Exhaust outlet adjustable to any angle. Used, guaranteed excellent condition. 150 for immediate delivery at

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NEW-USED
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Steam, Gas and Electric Power Equipment
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Moloney—60 Cycle, 20 Amp. Type SLB, Primary 7200/6180 — WYE, Secondary 203/406 2-10KW, 1-15KW, 6-25KW, 1-30KW.

Practically New
Priced to sell

GLAZER BROS.
Anderson, Ind.

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2—Engine driven generators, 2300 v., 325 KVA Allis-Chalmers and 460 KW G.E. Details on request.

1—300 KW Ridgeway M.G. set 250/275 DC 3/60/2300 syn. with controls.

1—750 KW, 250 volt D.C. Generator, direct connected, single bearing.

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WATERTUBE BOILER

Due to cancellation, available for immediate delivery 35,000# per hour 450 psi. Boiler with or without superheat. Can be furnished with either spreader stokers or mechanical atomizing oil burners.

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50, 60, 150, 250, 350 HP Slip Ring Motors
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180 HP (3) ASME 150# P. HRT Boilers
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25 Ton Shaw O.E.T. Crane, 60' Span
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1500 H.P.—1250 KVA
Nelseco — General Electric
Modern, Supercharged, Bosch Injection
3/60/2400, 300 RPM. All Accessories, Complete
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ALL SIZES
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DIESEL SETS — (New) 800 KW, A/C, 600 RPM

BOILERS — 1000 HP, 250#, Water Walls, etc.

BOILER — 300 HP, Single Drum, 200#, Gas Fired, Complete

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150 H.P.—2200V.—SYN. MOTOR

Westinghouse—80% P.F. 3 ph. 60 cy. 720 RPM.—24 hr. 100% load—50°—complete with direct connected exciter and reduced voltage starting control panel.

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New & Guaranteed Rebuilts
Stationary & Portable

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25 cy. 60 cy. D.C.

ALL VOLTAGES
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Three (3) 110 KVA used inside transformers, excellent condition.
2200 Volts primary, 440 Volts secondary, 60 cycles, single phase, O.I.S.C.
Westinghouse Serial Nos. 348134, 348137, 351917.
Equipment located at 888 Newark Ave., Jersey City, N. J.
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A.C. GENERATOR

Westinghouse alternating current generator—250 KVA 2400 volts—60 amps per terminal—3 phase—60 cycles 600 R.P.M. Serial #738397 with Exciter.

THE NEW YORK AIR BRAKE COMPANY
Watertown, New York

STEAM ENGINE

400 H. P. at 150 lb. p. left-hand Watts-Campbell engine—excellent condition—just stopped after conversion to electricity. 20⅛" bore—48" stroke—80 R.P.M.—fly wheel—14 foot x 38 inches—can be seen and run, easily removed from foundation.

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For synchronous motors 200 H.P. and 250 H.P. 3-60-4150
Automatic Magnetic Reversible. Reduced Voltage Starters—1—165 H.P. 440 Volt for Slip Ring motor. 1—100 H.P. 250 Volt D.C.

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SINCE 1912

PARTIAL LISTINGS

SIX—400 H. P.—225 LB. STEEL ENCASED CROSS DRUM TYPE—WATER TUBE BOILERS—OIL FIRED.

ONE—400 H. P.—300 LB. WATER TUBE, CROSS DRUM TYPE BOILERS. ASME.

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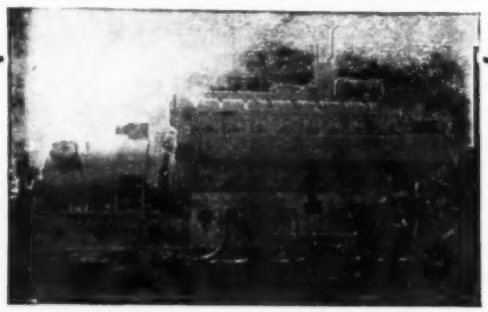

200 KW General Motors Diesel Model 8-268A, 450/60/3

IMMEDIATE DELIVERY on 100 KW, 200 KW to 1000 KW sets

LOWEST PRICES for complete diesel sets

Auxiliary equipment to suit your requirements.

AS IS Load tested, Hunt report good condition. **OR** **GUARANTEED** Completely rebuilt. Load tested, Hunt Co. survey.

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Rebuilt Pumps in Centrifugals

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2200V 60 CYC. 3 PH.

1— 50 H.P. G.E. KR 527, 1800 RPM.
1— 50 H.P. G.E. MT slipring, 695 RPM.
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1—100 H.P. G.E. KT 1800 RPM.
1—100 H.P. G.E. I-K 1800 RPM.

220/550V.

1—50 H.P. G.E. MTY 346, 690 RPM.

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1—7½ H.P. G.E. MT 952, 1160 RPM. SB 440V.
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1—7½ H.P. G.E. MT 900 RPM.
1— 15 H.P. West. CW 900 RPM.
1— 20 H.P. G.E. MT 512, 1200 RPM.
1— 30 H.P. West. CI 638, 900 RPM.
1— 30 H.P. West. CI 690 RPM.
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1—50 KW West. MG set, 125 V. 1150 RPM. compound wound, complete with charging panels.

Penn Electrical Engineering Co.

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FOR SALE—

1—16 x 21 Chuse Non-Condensing 150 KW generating unit
1—18 x 21 Chuse Non-Condensing 210 KVA generating unit
1—25 x 28 Chuse Non-Condensing 450 KVA generating unit
1—450 HP Bruce-McBeth late type Natural Gas Engine
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2—80 HP Bruce-McBeth late type Natural Gas engines

Fairbanks-Morse diesel engines 80 HP up to 420 HP with generators. Some have clutches.

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1—Riley No. 4-LH-New 1936

1—Riley No. 4-RH-New 1940

Excellent Condition with

2 Geared Steam Turbines

Priced to sell

GLAZER BROS.
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BRAND NEW

120,000 CFM, Type "K" Buffalo Forge Mfgr. Fans deliver 120,000 CFM @ ½" S.P., 314 RPM at 110°F.

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Nearly new smoke stack 48" dia x 100' long—¼" material.

Used smoke stack 24" dia. x 70' long—¼" material

Used 36" dia. smoke stack 52'6" long—3/16" material

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Used 20" dia. smoke stack 20' long—heavy

100 HP Scotch marine boiler equipped with Webster gas burner and with safety valves, water column, steam gauge, blowoff valves, coal grate and 28" x 50' used smoke stack. 130# W.P.

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FOR SALE:

(Used) 1 Single Retort Westinghouse Underfeed Stoker for 200 to 400 H. P., all new spare furnace parts never under fire, Ser. No. 9571. Complete outfit. First class condition.

(Used) 1 Dual Nozzle Iron Fireman Spreader Stoker, complete with Undergrate Fans, Furnace Parts, Boiler Front and Doors, Combustion Controls, Master Regulator, Full Floating Feed coal and air, arranged to fire two boilers 150 to 200 H. P. with this unit.

2 North American Oil Burners, complete for No. 6 oil, Turbo Blowers, 2¾ H. P. motors, complete with all accessories. (This equipment has never been uncrated, brand-new.) Capacity approximately 400 boiler horsepower.

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Diesel & Gasoline - Driven
5 KW to 700 KW - AC or DC

International Harvester and Chicago Pneumatic engines driving G.E. or Electric Machinery Co. generators.

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SQUIRREL CAGE MOTORS
(NEMA Frame)
220/440 volts, 3 ph., 60 cycle

Qu.	HP	RPM	Make	Type
10	1	1800	A.C., G.E	BB, DP—New
7	1	1200	L.A.	TEXP
20	1	1800	L.A.	TEXP
10	2	1800	Al. Ch.	BB, DP—New
35	3	1800	Al. Ch.	BB, DP—New
30	5	1800	A-C, G.E.	BB, DP—New
10	7½	1800	L. Allis	OGX—New
2	10	530	Wagner	HS-HT—R&G
1	10	900	G.E.	SB-DP—New
7	10	1800	Al. Ch.	OBB—New
2	10	3600	Al. Ch.	OBB—New
2	10	3600	G.E.	BB, DP—R&G
3	15	1200	G.E.	BB, DP—New
2	15	1200	G.E., Wstg.	HT—New
1	15	3600	G.E.	SB,DP—New
5	20	1200	Al. Ch.	OBB—New
2	25	1200	Al. Ch.	OBB—New
2	30	1800	Al. Ch.	OBB—New
3	50	1200	Al. Ch.	OBB—New
1	50	1800	Al. Ch.	OBB—New
1	125	1800	Al. Ch.	OSB—New

D. C. MOTORS, 230 VOLTS, ADJUSTABLE SPEED, RECONDITIONED AND GUARANTEED
(Except New Where Shown)

1	3	1150/2815 Rel.	14-T, Shunt
2	3/5	600/1800 Wstg.	SK-50
3	3½/5½	500/1500 Wstg.	SK-60
2	3/5	1150/3450 G.E.	Type B, Shunt
2	5/7½	400/1600 Wstg.	SK
5	7½/10	450/1800 Rel.	92-T, Shunt
2	5/7½	500/2000 Rel.	L. A. Shunt
1	10	250/1000 C.C.	Type L
2	10	300/1200 G.E.	RLC-201, Shunt
3	10	500/1500 Rel.	78-TF, Shunt
2	10	550/1650 E.C.K.	Shunt
7	10/15	575/2300 G.E.	DC-85
3	11½	500/1500 Wstg.	SK
3	15/20	400/1200 G.E.	RLC203A, Shunt
1	15/20	600/1800 Rel.	131-T
3	20/25	400/1200 G.E., E-D	
7	20/25	600/2000 G.E.	CD-105
1	30/40	400/1200 G.E.	RLC-204
1	35	500/1500 G.E.	RF13, 2 hrs. 50°
3	40	250/1500 G.E.	CD-1441
2	50	525/1900 G.E.	COM-TE-Dbl. Shaft—New
2	60/75	375/1200 E-D	25-SG
1	150	262/750 G.E.	Frame MPC

SPECIALS

1—250 H.P. R&G G.E. 720 R.P.M. motor, 440-3-60 mill line torques, 80% P.F., complete with direct connected exciter.
5—Reliance 40-VS drives, with 40/50 H.P. D.C. motors and complete A.C.-D.C. controls 220/440-3-60.
18—3 KW M-G Sets, 250 volts D.C., 220/440 volts A.C., drip-proof, flat compounded.
20—New Harnishchfeger Electric Hoists, 500 to 2000 lbs. capacity, 220/440/550 volts.
2—New Cutler-Hammer Bulletin 9586, Size 6, Across-the-Line Starters, 400 H.P., 440 volts, with O/L relay.
We can furnish any A.C. or D.C. control to your specifications up to 1000 H.P., 4160 volts.

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3 PHASE—1 PHASE
15 to 62½ KVA

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D.C. MOTOR GENERATOR SETS TO 75 KW • HIGH CYCLE GENERATORS
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WURTH ELECTRIC MOTOR COMPANY
Motors, Generators, Alternators, Frequency Changers.
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Self-Contained Boilers

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M. J. HUNT'S SONS
1600 No. Delaware Ave., Phila. 25, Pa.

FOR SALE
2 Vertical type Boilers
1—35 HP; 1—40 HP
in good condition.
Includes accessories and stokers.
Subject to prior sale, f.o.b. York, Pa.
THE SENECA WIRE & MFG. CO.
FOSTORIA, OHIO

MOTOR GENERATOR SETS & ROTARY CONVERTERS

Capacity	Make	Input	Output	Speed
60KVA	Gen. Elec.	220/3/60	250 V.D.C.	1800
50KVA	Gen. Elec.	220/3/60	250 V.D.C.	1800
37½KW	Westinghouse	220/3/60	125 V.D.C.	1160
17½KW	Gen. Elec.	220/3/60	125 V.D.C.	1800
15KW	A. B. Lee	220 D.C.	220 V.D.C.	1800
300 amp.	Elec. Prod.	440/3/60	42 V.D.C.	1750
10KW	Gen. Elec.	230 V.D.C.	115/230/2/60	1800
10KVA	Burke	110/3/60	230 V.D.C.	1800
10KW	Hertner	220/3/60	220 V.D.C.	1750
10KW	Al. Chalmers	440/3/60	125 V.D.C.	1150
7½KW	Westinghouse	220/3/60	220/3/180	1800
7½KVA	Columbia	220 V.D.C.	110/3/60	1800
4.4 KW	Westinghouse	220/3/60	80 V.D.C.	1750
3KW	Acme	220/3/60	60 V.D.C.	1750
3KW	Reliance	220,440/3/60	250 V.D.C.	1800
2½KW	Elec. Prod.	440/3/60	30/45 D.C.	1750
2½KW	Elec. Prod.	220/1/60	90/107 D.C.	1800
2KW	Elec. Prod.	220/3/60	38/45 D.C.	1800
2KW	Hertner	440/3/60	45 V.D.C.	1800
1¾KW	Elec. Prod.	220/3/60	33/39 D.C.	1750
2KW	Continental	115/3/60	115 V.D.C.	1800
2KW	Westinghouse	220,440/3/60	250 V.D.C.	1750
1.71KW	Louis Allis	440/3/60	360 V.D.C.	1750
1½KW	Westinghouse	220,440/3/60	230 V.D.C.	1750
1½KVA	Continental	220 V.D.C.	110/3/60	1800
1KW	Gen. Elec.	220/3/60	115 V.D.C.	1750
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Of Power, published monthly, with 13th issue in December at Albany, N. Y., for October 1, 1947.

State of New York} ss.
County of New York}

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. A. Gerardi, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company Inc., publishers of POWER and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

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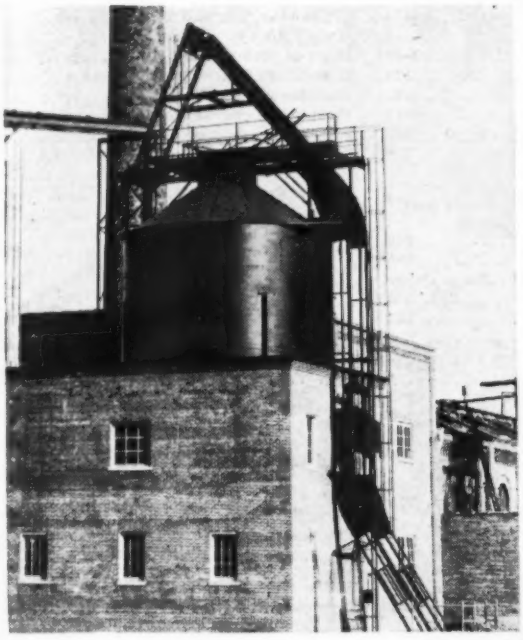
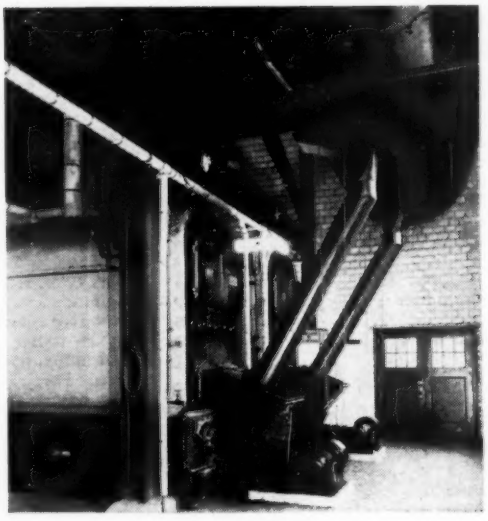
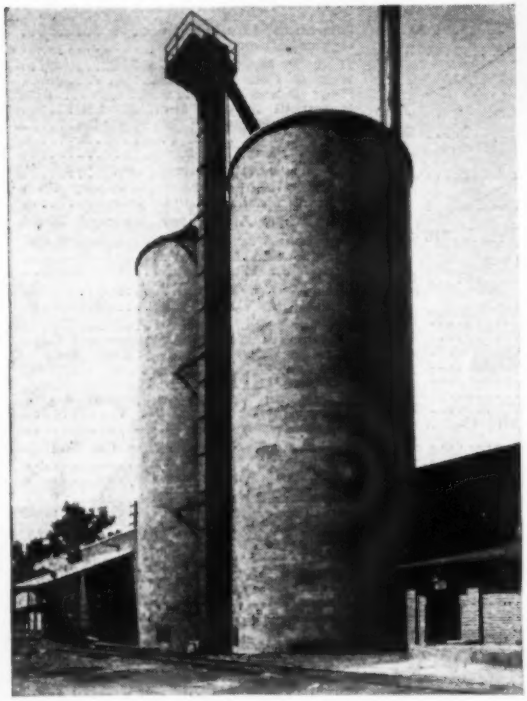
CYLINDRICAL OR SUSPENSION BUNKERS–SILOS







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• To meet the various requirements of power plants Fairfield designs—builds and erects equipment to meet specific needs.

Top left shows a cylindrical steel bunker of 200 ton capacity. Coal is received in railroad cars and delivered to bunker by a skip hoist having 30 tons per hour capacity. A motor propelled weigh larry discharges coal to the stokers.

Top right shows a steel suspension bunker employing chutes for discharging coal to stokers.

At the left is shown a typical twin silo installation for 800 ton coal storage outside of boiler house. Coal is fed automatically from car to storage to pulverizer or stoker.

Hundreds of plants in all sections of the country are using Fairfield equipment for coal and ash handling. Each of these has been designed to meet a specific need.

If you contemplate erecting a new plant—conversion to coal—or an addition to your present plant facilities, it will pay you to consult a Fairfield engineer on your coal and ash handling. Write for details.

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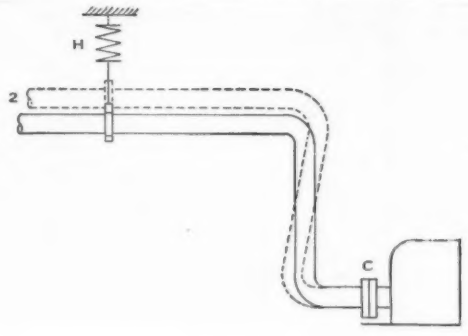
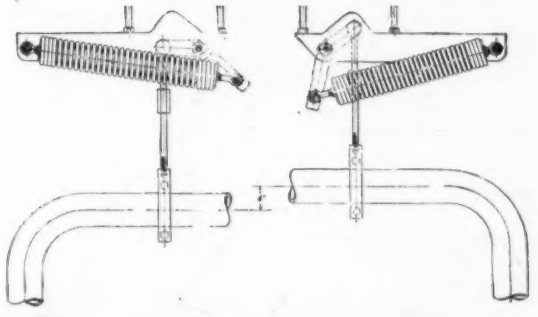
Are Weight Transfer Stresses Endangering Your Piping System?

THE PROBLEM:

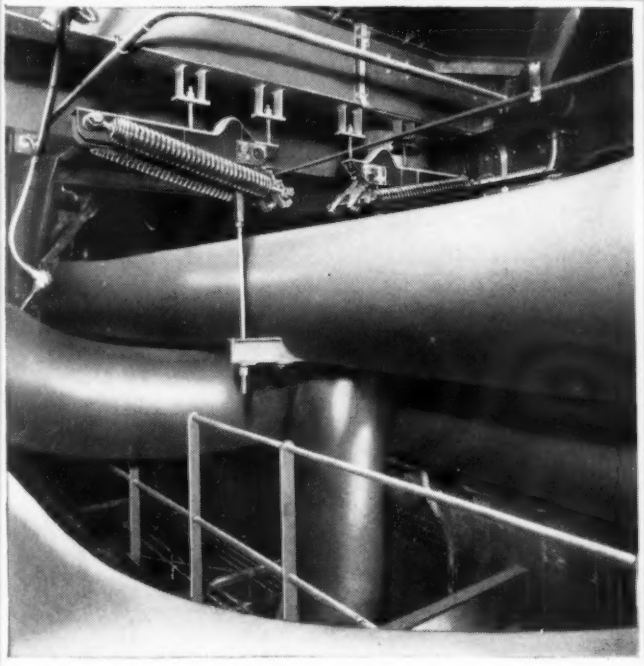


If the full safety factor is to be maintained in piping, then any weight transfer stresses caused by vertical movement of piping due to expansion or contraction, load change, surge or vibration must be eliminated. Diagram illustrates this problem—if pipe hangers "H" do not support full weight of the piping "P" in both cold position "1" and hot position "2", then dangerous stresses may result at connections "C".

THE SOLUTION:



Provide constant support to the piping throughout the entire range of vertical movement with Grinnell Constant-Support Hangers—the *only* constant support hangers. A lever, turning on the main pivot, balances the weight of a vertically shifting load because the change in moment arm with lever rotation is such that the product of the moment arm and the spring force is always constant and equal to the weight of the piping system.

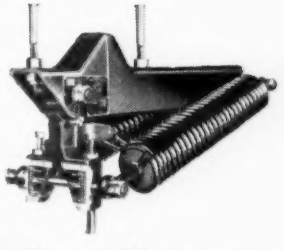


Main steam line at Hell Gate Station of Consolidated Edison Company is provided constant support by Grinnell Constant-Support Hangers.

GRINNELL CONSTANT-SUPPORT HANGERS

FEATURES:

- Constant support of piping in all "Hot" and "Cold" positions.
- Full safety factor of the supported system is always maintained.
- Non-resonant, energy absorbing.
- Mass-produced from standard precision parts.
- Individually calibrated for each installation.
- Load-adjustment features incorporated into the design.



- Three models meet entire range of load-travel specifications.
- Minimum headroom required.

Write for data book containing complete details.

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